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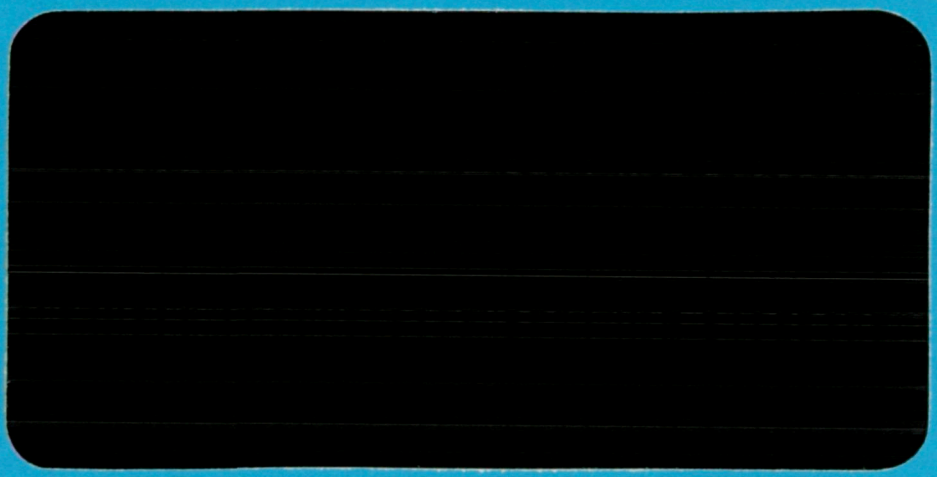

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GOODYEAR AEROSPACE
CORPORATION

AKRON, OHIO 44315

FINAL REPORT

SCALE DROGUE PARACHUTE MODEL

CONTRACT NAS8-30848

GER-16130 JULY 1974

Prepared for

George C Marshall Space Flight Center
Huntsville, Alabama

Prepared by

Goodyear Aerospace Corporation
Akron, Ohio

FOREWORD

This report has been prepared by Goodyear Aerospace Corporation (GAC) under Contract NAS-8-30848 entitled, "Scale Drogue Parachute Models," for the George C Marshall Space Flight Center of the National Aeronautics and Space Administration. The work of this contract was performed from April 30, 1974 through June 28, 1974.

The primary contributing personnel at Goodyear Aerospace was Mr. Daniel Henke project engineer.

The MSFC project engineer was Mr. David Baachus, S&E - AERO - AAV.

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1. Summary

Under Contract NAS8-30848, Goodyear Aerospace Corporation provided to George C Marshall Space Flight Center the following.

a. Three 12.5% scale drogue parachute models as described in NASA supplied drawing 86375 which has a porosity of 16% and three 12.5% scale drogue parachute models as described in NASA supplied drawing 86376 which has a porosity of 24%.

   Deployment bags were furnished for each of the six drogue parachute models in accordance with NASA supplied drawing 86377.

b. Two 12.5% scale pilot parachute models as outlined in the NASA supplied drawing 86378. Deployment bags were furnished for each of the two pilot parachute models in accordance with GAC drawing 74QS892.

c. This final report.

In supplying the above hardware, GAC also.

a. Reviewed each of the drawings. Recommendations were made and incorporated into the fabrication of the parachutes and deployment bags.

b. Fabricated tooling aids for the 86375-1, 86376-1, and the 86378-1 parachutes to insure accurate placement of the horizontal ribbons and radial tapes during fabrication of the gores.

c. Obtained dimensional measurements and overall porosity measurements on each of the parachutes fabricated to insure a data base for interpretation of the wind tunnel test data.

2. Drawing Review

The drogue parachute models, pilot parachute models and their deployment bags were fabricated according to the following drawing.

drogue parachute model	Dwg. No. 86375 and Dwg. No. 86376
deployment bag	Dwg. No. 86377
pilot parachute	Dwg. No. 86378

A copy of each is contained in Appendix A.

In addition, GAC fabricated two pilot deployment bags according to GAC drawing 74QS892. A copy of this drawing is also contained in Appendix A.

Each of the drawings were reviewed for consistency of design in light of their intended use with the result that the changes listed in Tables I through V, were recommended and incorporated into the design of the parachute.

The major difference between the original drawing and that recommended by GAC was the number of horizontal ribbons in each parachute to maintain the desired geometric porosity.

Examination of the MIL-T-5608 Class A, Type I, 1/4 inch wide material received for use as horizontal ribbons in the parachute showed that the material was generally less than the nominal 0.25 inches width as defined in the specification. Ten rolls of the 41 received were measured using a 1/100 inch scale steel rule under 2X magnification. The average width of the ten rolls was 0.234 inches. The specification defines the width tolerance as $\pm$ 0.0156 inches. For the low tolerance the allowable width is 0.2344 inches.

Table I - Changes to Drawing 86375 for S/N 001 and S/N 002

Zone	Item	Was	Is Now	Reason
11-H	-15 vent band	MIL-T-5608, Type I, CL.A. 13 lb. (2 ply)	MIL-T-5608, Type I, CL.C. 39 lb. (1 ply)	Better mass simulation
20-G	Connector link	101735 Link Capewell Mfg. Co.	MS 22021-1 Connector link	Wrong size item called out
7-H	General Note #1	Size E nylon thread	Size B nylon thread (unless other-wise specified)	Better mass simulation
2-D	Parts list	-	Size B nylon thread	Additional material
11-A	Gore dimension	37.45	37.38	To maintain porosity with present material (material width equal to spec minimum)
10-B	Horizontal ribbon	125 Req'd	133 Req'd	" " "
9-B	Gap dimension	124 equal spaces at 0.05	132 equal spaces at 0.047	" " "
5-D	-19 Keeper	MIL-T-2283 1/2", 90#	MIL-T-5608 Type III Class C 5/8", 90#	Better mass simulation

Table II - Changes to Drawing 86375 for S/N 003

Zone	Item	Was	Is Now	Reason
10-B	-7 Horizontal Ribbon	MIL-T-5038 Type I Class A	MIL-T-5038 Type I Class C	Availability of Material
12-C	-9 Radial Tape	MIL-T-5038 Type I Class A	MIL-T-5038 Type I Class C	Availability of Material
16-G	-21 Pocket Band	MIL-T-5038 Type I Class A	MIL-T-5038 Type I Class C	Availability of Material

Table III - Changes to Drawing 86376

Zone	Item	Was	Is Now	Reason
11-H	-15 Vent band	MIL-T-5608, Type I, CL.A. 13 lb. (2 ply)	MIL-T-5608, Type I, CL.C 39 lb. (1 ply)	Better mass simulation
20-G	Connector link	101735 Link Capewell Mfg Co.	MS 22021-1 Connector link	Wrong size item called out
7-H	General Note #1	Size E nylon thread	Size B nylon thread (unless otherwise specified)	Better mass simulation
2-D	Parts List	—	Size B nylon thread	Additional material
11-A	Gore dimension	37.37	37.25	To maintain porosity with present material (material width equal to spec minimum)
10-B	Horizontal ribbon	111 req'd	118 req'd	" " "
9-B	Gap dimension	110 equal spaces at 0.0875	117 equal spaces at 0.082	" " "
6-D	-19 Keeper	MIL-T-2283 1/2", 90#	MIL-T-5608 Type III Class C 5/8", 90#	Better mass simulation

Table IV - Changes to Drawing 86377

Zone	Item	Was	Is Now	Reason
8-B 7-C 7-D 22-D 22-C 7-E 6-D 8-E	-7 Band -9 Strap -11 Strap -27 Strap -29 Strap -31 Loop -33 Keeper -35 Loop	MIL-T-5038 Type III 3/8"	MIL-T-5038 Type III 1/2"	Better mass simulation
22-C	-25 Loop	MIL-T-5661 Type I 3/8", 120#	MIL-T-5661 Type III 3/4", 75# 2 ply, folded	Better mass simulation
12-B	-37 Loop	MIL-T-5661 Type I 3/8", 120#	MIL-T-5661 Type III 3/4", 75# 2 ply, folded	Better mass simulation

Table V - Changes to Drawing 86378

Zone	Item	Was	Is Now	Reason
7-H	General Note #1	Size E nylon thread	Size B thread unless otherwise specified	Better mass simulation
2-O	Parts List	—	Size B nylon thread	Additional Material
8-B	Horizontal ribbon	16 req'd	17 req'd	Maintain porosity with present material (material width equal to spec minimum)
8-B	Gap dimension	.10 slot type	.095 slot type	" " "

Considering the measurement method utilized, the average width was equal to the minimum specification value.

Discussions with MSFC established that the established geometric porosity of 16% and 24% for the drogue models and 24% for the pilot model should be maintained. Therefore the recommended action was to increase the number of horizontal ribbons.

Table VI lists the number of ribbons used, the gap width and length of gore used to obtain the correct geometric porosity for each of the parachutes. As can be seen from the table, all of the units changed except 86375-1 S/N 003, which, when additional material was ordered to fabricate this unit, the horizontal ribbon material measured the nominal 0.25 inches. Therefore no change was required and this unit remained a 125 ribbon parachute.

3. Manufacture of the Parachute

The manufacturing of the parachutes and deployment bags took place in Goodyear Aerospace Corporation's fabric development area.

Four tooling aids were fabricated to aid in the construction of the gores for the various parachutes. One tooling aid was fabricated for each of the 86376-1 and 86378-1 parachutes. Two tooling aids were fabricated for the 86375-1 parachute, the first containing 133 horizontal ribbons for S/N 001 and S/N 002 and the second with 125 ribbons for S/N 003.

Using the tooling aids allowed for uniform, quick and accurate fabrication of the parachute gores with a minimum of handling small lengths of ribbon.

Figures 1, 2 and 3 show a typical completed canopy.

Table VI - Number of Horizontal Ribbons Increased to Maintain the Correct Geometric Porosity

Dwg. No.	Serial No.	Was				Revised (1)			
		No. of Ribbons	Ribbon Width (Inches)	Gap Width (Inches)	Gore Length (Inches) (2)	No. of Ribbons	Ribbon Width (Inches)	Gap Width (Inches)	Gore Length (Inches) (2)
86375	001,002 (3)	125	0.25	0.050	37.45	133	0.2344	0.047	37.38
86376	001,002,003	111	0.25	0.0875	37.37	118	0.2344	0.082	37.25
86378		16	0.25	0.100	5.50	17	0.2344	0.095	5.50

Notes:
(1) Changes were defined by maintaining a constant ratio of gap *width/ribbon width*

(2) Measured from vent band to skirt band, total length for gore layout remains 41.75 per drawing 68375 and 68376

(3) S/N 003 remained at the 125 ribbon, 0.25 ribbon width, 0.050 gap width and 37.45 gore length

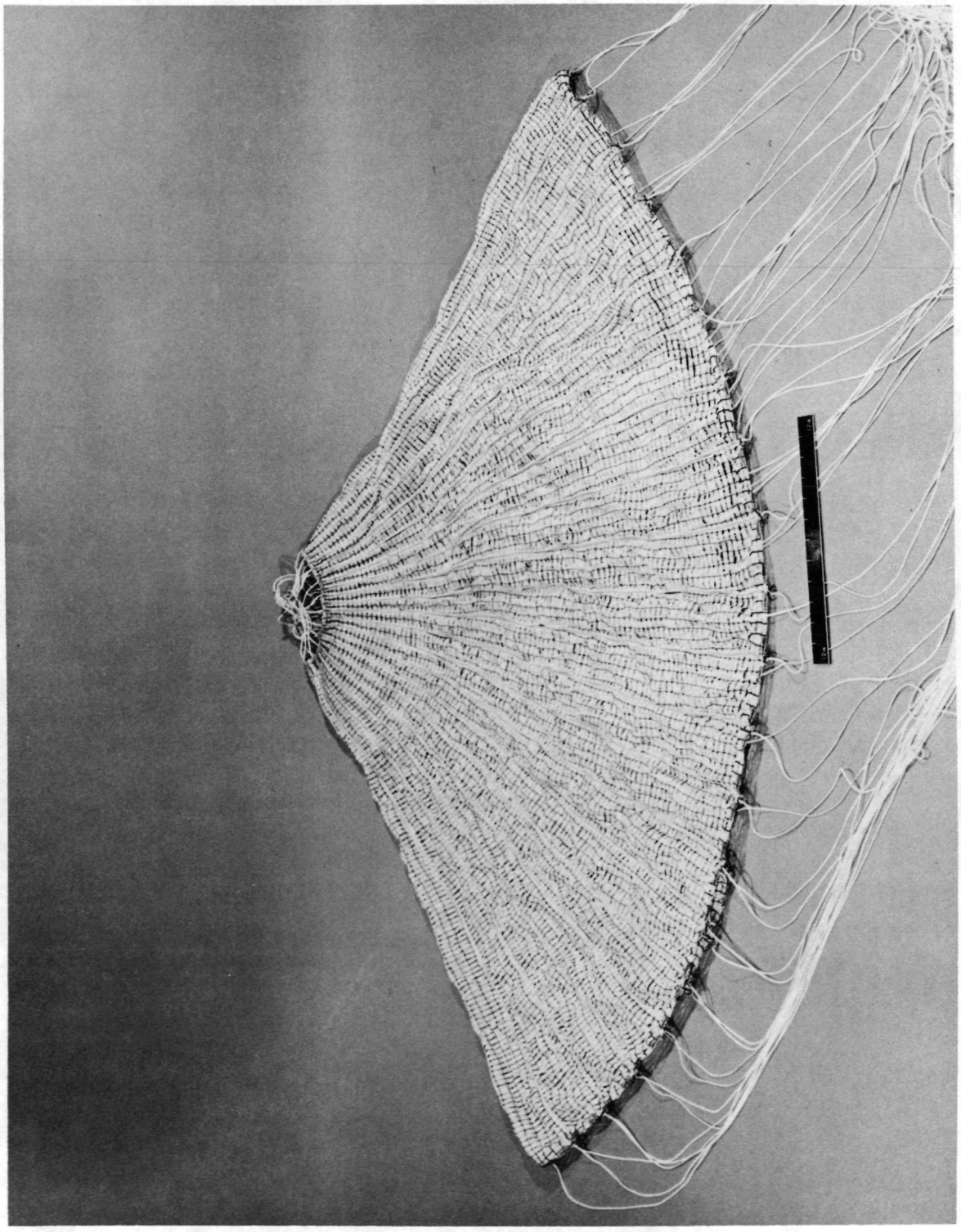


Figure 1 - Photograph of one of the Manufactured Canopies

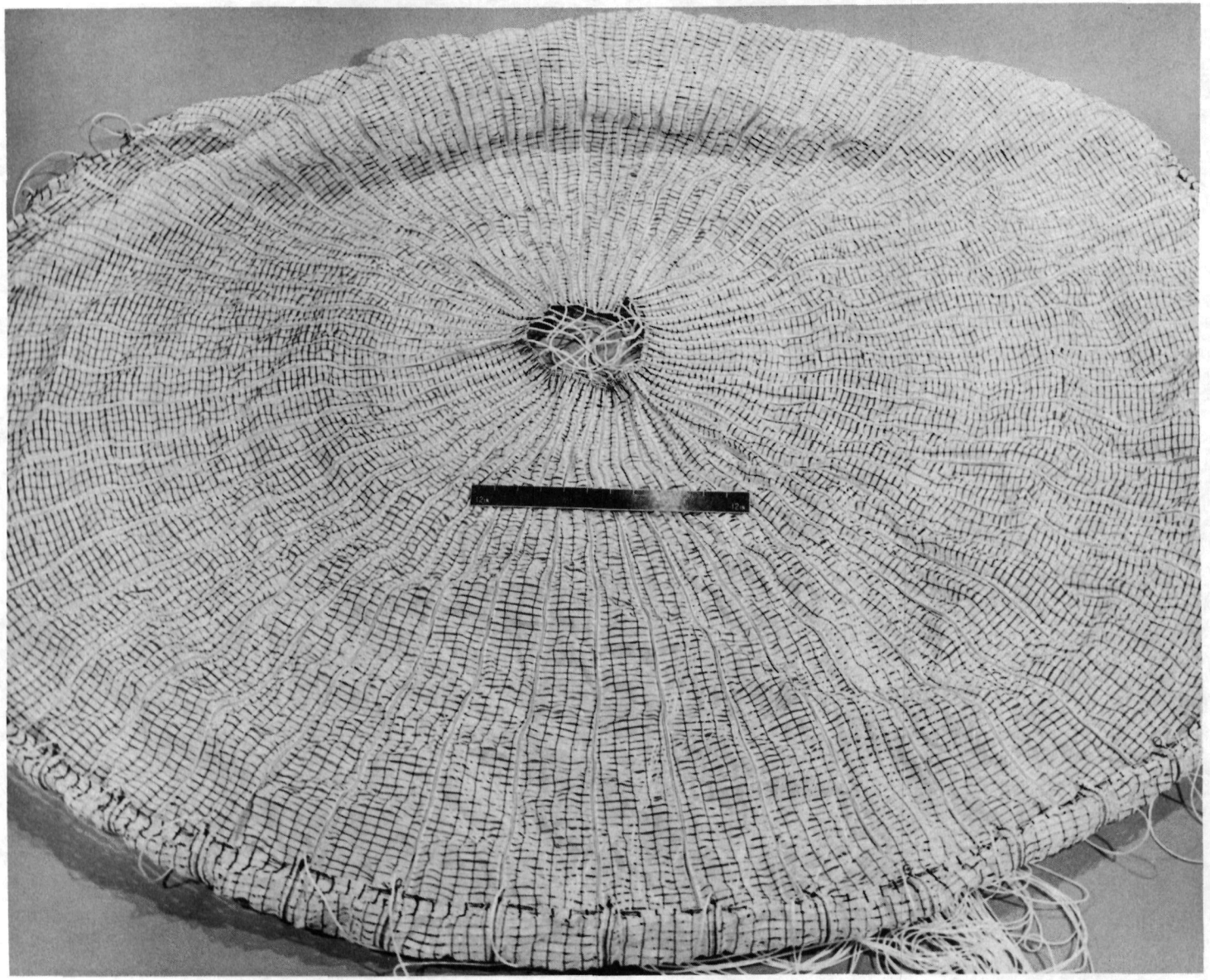


Figure 2 - Photograph of the Drag Producing Surface on One Of the Manufactured Canopies

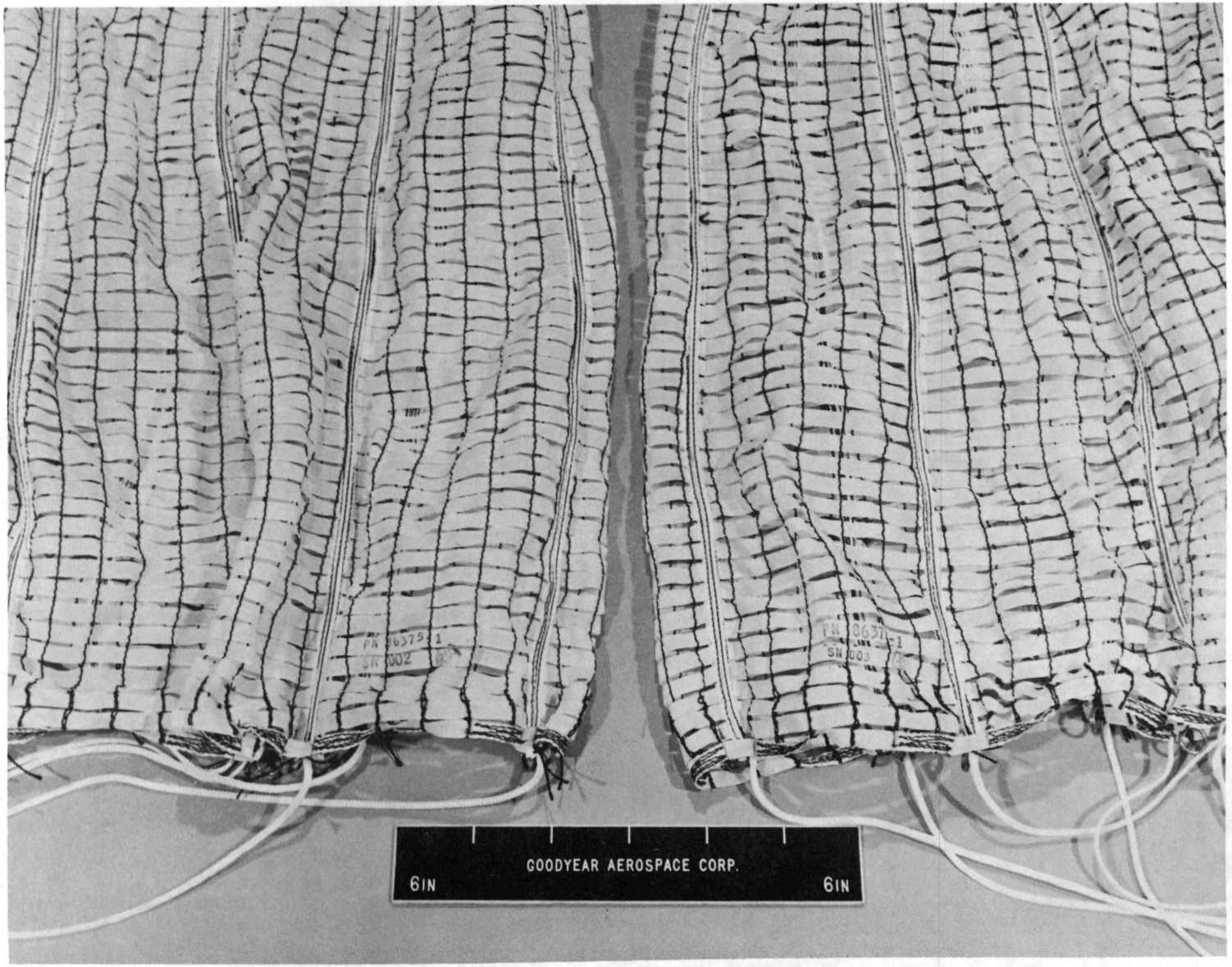


Figure 3 - Detail View of Parachute 36375-1 S/N 002 and 36376-1 S/N 003

The riser and deployment bags did not require any special tools and were fabricated by conventional methods. See figure 4.

Fabrication was handled by fabric development personnel who are qualified as parachute material cutters, sewing machine operators, parachute fabricators and parachute riggers.

Fabrication was handled in a step-by-step manner by the use of process cards.

No fabrication problems were encountered during construction of any of the canopies, risers, or deployment bags.

4. Measurements

After fabrication, the following measurements were recorded for each parachute.

a. Linear dimensions as shown in figure 5.

These dimensions are contained in Tables VII through XII. The tension on each member at the time of measurements and the accuracy of each measurement is also shown in the table. Dimensions were taken with a scale whose divisions were marked in 1/16 of an inch.

b. Overall Porosity

To establish the overall porosity of each parachute (material porosity and the geometric porosity) a Frazier Diffusion test was conducted at eight locations for the 86375-1 and 86376-1 parachutes and at four locations for the 86378-1 parachutes.

For the 86375-1 and 86376-1 parachutes the measurements were taken at the skirt and at mid gore on gores #1, 14, 27 and 40.

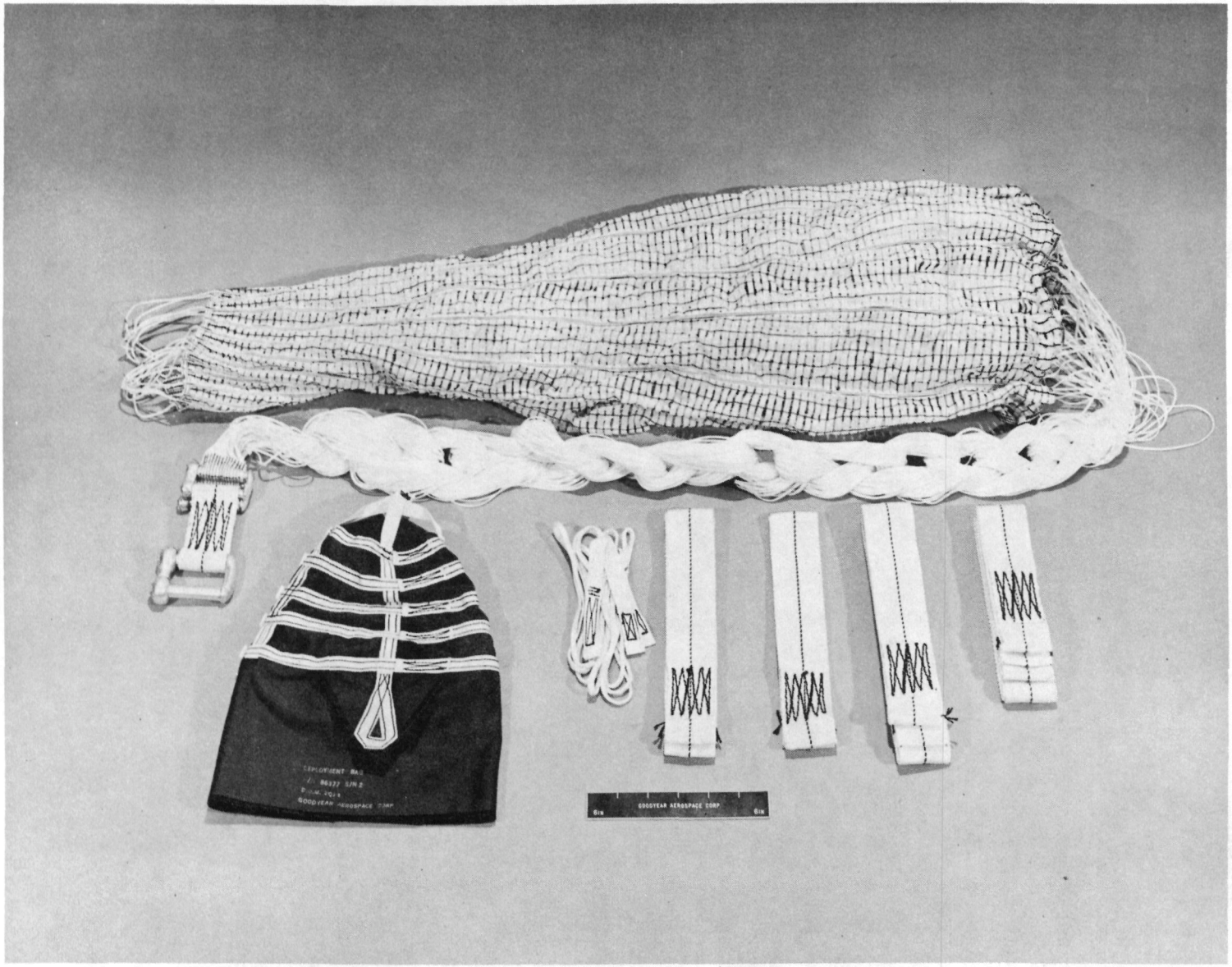
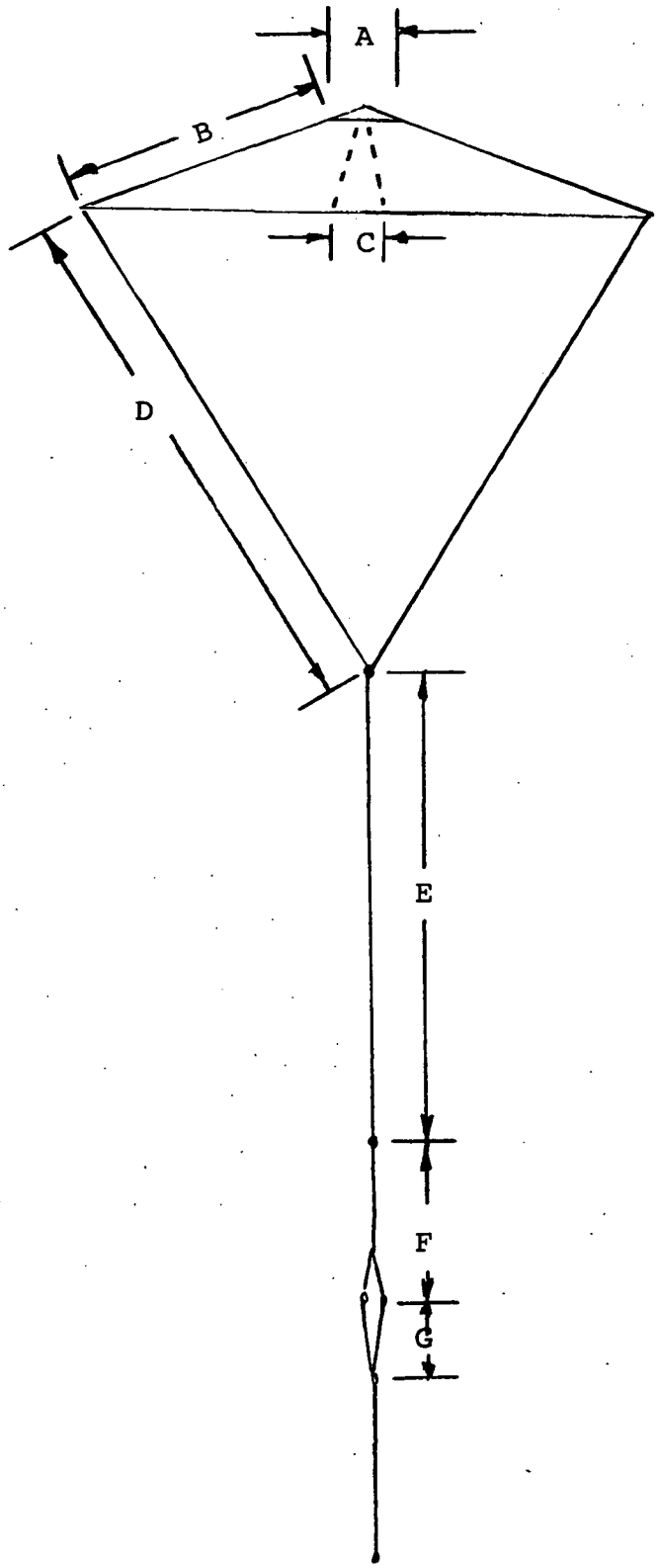


Figure 4 - Photograph of a Manufactured Pilot Deployment Bag, Various Length Risers and Canopy



Dimension A,B,C,D measured for each gore or suspension line.

Figure 5 - Dimensions Recorded on Each Parachute to Establish Symmetry

Table VII - Linear Dimensions for Parachute P/N 86375-1 S/N 001

	A		B		C			
GORE	CM	INCHES	CM	INCHES	CM	INCHES	CM	INCHES
1	19.4	7-5/8	92.7	36-1/2	11.1	4-3/8	206.4	81-1/4
2			92.1	36-1/4	11.3	4-7/16	206.4	81-1/4
3	19.7	7-3/4	92.7	36-1/2	11.4	4-1/2	206.4	81-1/4
4	19.7	7-3/4	91.4	36	11.3	4-7/16		
5			92.1	36-1/4	11.3	4-7/16		
6	19.7	7-3/4	92.7	36-1/2	11.1	4-3/8	Not	Not
7			92.7	36-1/2	11.1	4-3/8	Tacked	Tacked
8	19.7	7-3/4	92.1	36-1/4	11.1	4-3/8		
9			92.1	36-1/4	11.1	4-3/8		
10	19.7	7-3/4	92.1	36-1/4	11.3	4-7/16		
11			92.1	36-1/4	11.1	4-3/8		
12	19.7	7-3/4	92.1	36-1/4	11.3	4-7/16		
13			92.7	36-1/2	11.3	4-7/16	207.0	81-1/2
14	19.7	7-3/4	92.1	36-1/4	11.1	4-3/8	205.7	81
15			92.1	36-1/4	11.4	4-1/2	205.7	81
16	19.7	7-3/4	92.1	36-1/4	11.3	4-7/16		
17			91.4	36	11.3	4-7/16		
18	19.7	7-3/4	92.1	36-1/4	11.3	4-7/16		
19			92.1	36-1/4	11.3	4-7/16	Not	Not
20	19.4	7-5/8	92.1	36-1/4	11.1	4-3/8	Tacked	Tacked
21			92.1	36-1/4	11.3	4-7/16		
22	19.7	7-3/4	92.1	36-1/4	11.1	4-3/8		
23			92.1	36-1/4	11.3	4-7/16		
24	19.7	7-3/4	91.4	36	11.1	4-3/8		
25			92.1	36-1/4	11.4	4-1/2		
26	19.7	7-3/4	92.7	36-1/2	11.4	4-1/2		
27			92.7	36-1/2	11.4	4-1/2		
28			92.1	36-1/4	11.3	4-7/16	205.7	81
29			92.7	36-1/2	11.1	4-3/8	205.7	81
30			92.7	36-1/2	11.4	4-1/2	205.7	81
31			92.7	36-1/2	11.3	4-7/16		
32			92.1	36-1/4	11.3	4-7/16		
33			92.1	36-1/4	11.1	4-3/8		
34			92.1	36-1/4	11.4	4-1/2		
35			92.7	36-1/2	11.3	4-7/16	Not	Not
36			92.7	36-1/2	11.4	4-1/2	Tacked	Tacked
37			92.7	36-1/2	11.4	4-1/2		
38			92.7	36-1/2	11.1	4-3/8		
39			92.7	36-1/2	11.3	4-7/16		
40			92.1	36-1/4	11.3	4-7/16	205.7	81
41			92.7	36-1/2	11.3	4-7/16	206.4	81-1/4
42			92.7	36-1/2	11.3	4-7/16	206.4	81-1/4
43			92.7	36-1/2	11.1	4-3/8		
44			92.1	36-1/4	11.3	4-7/16		
45			92.1	36-1/4	11.3	4-7/16	Not	Not
46			92.1	36-1/4	11.3	4-7/16	Tacked	Tacked
47			92.7	36-1/2	11.1	4-3/8		
48			92.7	36-1/2	11.1	4-3/8		
49			91.4	36	11.3	4-7/16		
50			92.1	36-1/4	11.1	4-3/8		
51			92.1	36-1/4	11.1	4-3/8		
52			92.1	36-1/4	11.3	4-7/16		
53			92.1	36-1/4	11.1	4-3/8		
54			92.7	36-1/2	11.3	4-7/16		
TENSION	NO SLACK		5 LBS.		1 LB.		5 LBS.	

F = 26.0 cm (10-1/4 in)
E+F = 227 cm (88-3/4 in)
G = 8.4 cm (3-1/2 in)

ACCURACY
B, D, E+F, F measured closest .6 cm (1/4 in)
A,G measured closest .3 cm (1/8 in)
C measured closest .16 cm (1/16 in)

Table VIII - Linear Dimensions for Parachute P/N 86375-1 S/N 002

GORE	A		B		C		D	
	CM	INCHES	CM	INCHES	CM	INCHES	CM	INCHES
1	19.7	7-3/4	92.1	36-1/4	11.4	4-1/2	205.7	81
2			92.7	36-1/2	11.4	4-1/2	206.4	81-1/4
3	19.2	7-1/2	92.7	36-1/2	11.1	4-3/8	205.7	81
4	19.7	7-3/4	92.7	36-1/2	11.3	4-7/16	↑	↑
5			92.1	36-1/4	11.3	4-7/16		
6	20.2	7-7/8	92.1	36-1/4	11.3	4-7/16		
7			92.1	36-1/4	11.1	4-3/8	Not	Not
8	19.7	7-3/4	92.7	36-1/2	11.4	4-1/2	Tacked	Tacked
9			92.7	36-1/2	11.3	4-7/16		
10	19.4	7-5/8	92.7	36-1/2	11.4	4-1/2		
11			92.7	36-1/2	11.4	4-1/2		
12	19.4	7-5/8	92.7	36-1/2	11.4	4-1/2		
13			92.1	36-1/4	11.1	4-3/8	206.4	81-1/4
14	19.7	7-3/4	92.1	36-1/4	11.3	4-7/16	206.4	81-1/4
15			92.7	36-1/2	11.3	4-7/16	205.7	81
16	19.4	7-5/8	92.7	36-1/2	11.3	4-7/16	↑	↑
17			92.1	36-1/4	11.1	4-3/8		
18	19.4	7-5/8	92.7	36-1/2	11.3	4-7/16		
19			92.1	36-1/4	11.3	4-7/16		
20	19.4	7-5/8	92.1	36-1/4	11.3	4-7/16	Not	Not
21			92.1	36-1/4	11.3	4-7/16	Tacked	Tacked
22	19.7	7-3/4	92.1	36-1/4	11.4	4-1/2		
23			92.1	36-1/4	11.1	4-3/8		
24	19.7	7-3/4	92.1	36-1/4	11.1	4-3/8		
25			92.1	36-1/4	11.3	4-7/16		
26	19.4	7-5/8	92.1	36-1/4	11.3	4-7/16		
27			92.1	36-1/4	11.1	4-3/8		
28			92.1	36-1/4	11.4	4-1/2	206.4	81-1/4
29			92.1	36-1/4	11.3	4-7/16	206.4	81-1/4
30			92.7	36-1/2	11.3	4-7/16	205.7	81
31			92.1	36-1/4	11.4	4-1/2	↑	↑
32			92.1	36-1/4	11.4	4-1/2		
33			92.1	36-1/4	11.4	4-1/2		
34			92.1	36-1/4	11.4	4-1/2	Not	Not
35			92.7	36-1/2	11.3	4-7/16	Tacked	Tacked
36			92.1	36-1/4	11.3	4-7/16		
37			92.7	36-1/2	11.1	4-3/8		
38			92.7	36-1/2	11.1	4-3/8		
39			92.7	36-1/2	11.1	4-3/8		
40			92.7	36-1/2	11.1	4-3/8	206.4	81-1/4
41			92.7	36-1/2	11.3	4-7/16	205.7	81
42			92.7	36-1/2	11.4	4-1/2	206.4	81-1/4
43			92.1	36-1/4	11.1	4-3/8	↑	↑
44			92.1	36-1/4	11.1	4-3/8		
45			92.7	36-1/2	11.1	4-3/8		
46			92.7	36-1/2	11.1	4-3/8	Not	Not
47			92.7	36-1/2	11.4	4-1/2	Tacked	Tacked
48			92.7	36-1/2	11.1	4-3/8		
49			92.1	36-1/4	11.3	4-7/16		
50			92.1	36-1/4	11.3	4-7/16		
51			92.1	36-1/4	11.1	4-3/8		
52			92.1	36-1/4	11.1	4-3/8		
53			92.1	36-1/4	11.3	4-7/16		
54			92.3	36-1/2	11.4	4-1/2		
TENSION	NO SLACK		5 LBS.		1 LB.		5 LBS	

F = 26.0 cm (10-1/4 in)
E+F = 227 cm (88-3/4 in)
G = 8.6 cm (3-3/8 in)

ACCURACY
B, D, E+F, F measured closest .6 cm (1/4 inch)
A, G measured closest .3 cm (1/8 inch)
C measured closest .16 cm (1/16 inch)

Table IX - Linear Dimensions for Parachute P/N 86375-1 S/N 003

GORE	A		B		C		D	
	CM	INCHES	CM	INCHES	CM	INCHES	CM	INCHES
1	19.2	7-1/2	92.4	36-3/8	11.1	4-3/8	205.7	81.0
2			92.4	36-3/8	11.3	4-7/16	205.7	81.0
3	19.2	7-1/2	92.4	36-3/8	11.3	4-7/16	206.4	81-1/4
4	19.2	7-1/2	92.7	36-1/2	11.1	4-3/8	↑	↑
5			92.4	36-3/8	11.3	4-7/16		
6	19.2	7-1/2	92.4	36-3/8	11.1	4-3/8	Not	Not
7			92.4	36-3/8	11.3	4-7/16	Tacked	Tacked
8	18.7	7-3/8	92.1	36-1/4	11.3	4-7/16		
9			92.4	36-3/8	11.1	4-3/8		
10	19.4	7-5/8	92.7	36-1/2	11/3	4-7/16		
11			92.7	36-1/2	11.3	4-7/16		
12	19.2	7-1/2	92.7	36-1/2	11.3	4-7/16		
13			92.7	36-1/2	11.3	4-7/16	206.0	81-1/8
14	19.4	7-5/8	92.7	36-1/2	11.4	4-1/2	205.7	81.0
15			92.4	36-3/8	11.3	4-7/16	205.7	81.0
16	19.2	7-1/2	92.4	36-3/8	11.1	4-3/8	↑	↑
17			92.4	36-3/8	11.4	4-1/2		
18	19.2	7-1/2	92.1	36-1/4	11.3	4-7/16	Not	Not
19			92.1	36-1/4	11.1	4-3/8	Tacked	Tacked
20	18.4	7-1/4	92.1	36-1/4	11.4	4-1/2		
21			92.4	36-3/8	11.4	4-1/2		
22	18.7	7-3/8	92.7	36-1/2	11.4	4-1/2		
23			92.4	36-3/8	11.3	4-7/16		
24	19.2	7-1/2	92.4	36-3/8	11.3	4-7/16		
25			92.4	36-3/8	11.3	4-7/16		
26	19.4	7-5/8	92.7	36-1/2	11.3	4-7/16		
27			92.7	36-1/2	11.4	4-1/2		
28			92.4	36-3/8	11.3	4-7/16	205.7	81.0
29			92.4	36-3/8	11.3	4-7/16	205.7	81.0
30			92.4	36-3/8	11.3	4-7/16	205.7	81.0
31			92.7	36-1/2	11.3	4-7/16	↑	↑
32			92.4	36-3/8	11.3	4-7/16		
33			92.7	36-1/2	11.1	4-3/8	Not	Not
34			92.7	36-1/2	11.3	4-7/16	Tacked	Tacked
35			92.7	36-1/2	11.4	4-1/2		
36			92.7	36-1/2	11.3	4-7/16		
37			92.7	36-1/2	11.3	4-7/16		
38			92.7	36-1/2	11.1	4-3/8		
39			92.7	36-1/2	11.3	4-7/16		
40			92.7	36-1/2	11.3	4-7/16	206.0	81-1/8
41			92.7	36-1/2	11.4	4-1/2	205.7	81.0
42			92.7	36-1/2	11.4	4-1/2	205.7	81.0
43			92.7	36-1/2	11.4	4-1/2	↑	↑
44			92.7	36-1/2	11.3	4-7/16		
45			93.1	36-5/8	11.3	4-7/16	Not	Not
46			92.7	36-1/2	11.4	4-1/2	Tacked	Tacked
47			92.7	36-1/2	11.3	4-7/16		
48			92.7	36-1/2	11.3	4-7/16		
49			93.1	36-5/8	11.4	4-1/2		
50			92.7	36-1/2	11.4	4-1/2		
51			92.4	36-3/8	11.3	4-7/16		
52			92.4	36-3/8	11.3	4-7/16		
53			92.4	36-3/8	11.3	4-7/16		
54			92.4	36-3/8	11.3	4-7/16		
TENSION	NO SLACK		5 LBS.		1 LB.		5 LBS.	

F = 26.0 cm (10-1/4 in)

E+F = 227 cm (88-3/4 in)

G = 8.4 cm (3-1/2 in)

ACCURACY

E+F, F measured closest .6 cm (1/4 inch)

A, B, D, G measured closest .3 cm (1/8 inch)

C measured closest .16 cm (1/16 inch)

Table X - Linear Dimensions for Parachute 86376-1 S/N 001

GORE	A		B		C		D	
	CM	INCHES	CM	INCHES	CM	INCHES	CM	INCHES
1	21.0	8-1/4	91.4	36		4-1/4	205.7	81
2			90.8	35-3/4	11.1	4-3/8	205.1	80-3/4
3	20.3	8	90.8	35-3/4	11.4	4-1/2	205.7	81
4	20.3	8	9.14	36	11.4	4-1/2	↑	↑
5			90.8	35-3/4	11.1	4-3/8		
6	19.7	7-3/4	91.4	36	11.1	4-3/8	Not	Not
7			90.8	35-3/4	10.8	4-1/4	Tacked	Tacked
8	19.7	7-3/4	90.8	35-3/4	11.4	4-1/2		
9			90.8	35-3/4	11.1	4-3/8		
10	19.7	7-3/4	90.8	35-3/4	11.1	4-3/8		
11			90.8	35-3/4	11.4	4-1/2		
12	19.4	7-5/8	90.8	35-3/4	11.4	4-1/2		
13			90.8	35-3/4	11.1	4-3/8	206.4	81-1/4
14	20.0	7-7/8	90.8	35-3/4	11.4	4-1/2	205.7	81
15			90.8	35-3/4	11.1	4-3/8	205.7	81
16	19.7	7-3/4	90.8	35-3/4	11.1	4-3/8	↑	↑
17			90.8	35-3/4	11.1	4-3/8		
18	20.3	8	90.8	35-3/4	11.1	4-3/8	Not	Not
19			90.8	35-3/4	11.1	4-3/8	Tacked	Tacked
20	18.4	7-1/4	90.8	35-3/4	11.1	4-3/8		
21			90.8	35-3/4	11.1	4-3/8		
22	20.0	7-7/8	90.8	35-3/4	11.1	4-3/8		
23			90.2	35-1/2	11.4	4-1/2		
24	19.1	7-1/2	90.8	35-3/4	11.1	4-3/8		
25			91.4	36	11.1	4-3/8		
26	20.0	7-7/8	90.8	35-3/4	11.1	4-3/8		
27			90.2	35-1/2	11.1	4-3/8		
28			91.4	36	10.8	4-1/4	205.7	81
29			90.8	35-3/4		4-1/4	205.7	81
30			90.8	35-3/4	11.4	4-1/2	205.7	81
31			90.8	35-3/4	11.1	4-3/8	↑	↑
32			90.8	35-3/4	11.1	4-3/8		
33			90.8	35-3/4	11.1	4-3/8	Not	Not
34			90.8	35-3/4	10.8	4-1/4	Tacked	Tacked
35			91.4	36	10.8	4-1/4		
36			90.8	35-3/4	11.1	4-3/8		
37			92.1	36-1/4	10.8	4-1/4		
38			90.8	35-3/4	10.8	4-1/4		
39			90.2	35-1/2	11.1	4-3/8		
40			90.2	35-1/2	10.8	4-1/4	205.7	81
41			90.8	35-3/4	11.1	4-3/8	205.7	81
42			90.2	35-1/2	11.1	4-3/8	205.7	81
43			90.8	35-3/4	11.1	4-3/8	↑	↑
44			91.4	36	11.1	4-3/8		
45			91.4	36	11.4	4-1/2	Not	Not
46			91.4	36	11.1	4-3/8	Tacked	Tacked
47			90.8	35-3/4	11.1	4-3/8		
48			90.8	35-3/4	11.1	4-3/8		
49			91.4	36	11.1	4-3/8		
50			90.8	35-3/4	11.1	4-3/8		
51			90.8	35-3/4	11.1	4-3/8		
52			90.8	35-3/4	11.4	4-1/2		
53			90.8	35-3/4	11.4	4-1/2		
54			91.4	36	11.4	4-1/2		
TENSION	NO SLACK		5 LBS.		1 LB.		5 LBS.	

F = 26.7 cm (10-1/2 In)

E+F = 229.2 (90-1/4 In) (No Slack)

G + 8.6 cm (3-3/8 In)

ACCURACY

B, D, E+F, F measured closest .6 cm (1/4 inch)

A, G measured closest .3 cm (1/8 inch)

C measured closest .16 (1/16 inch)

Table XI - Linear Dimensions for Parachute P/N 86376-1 S/N 002

	A		B		C		D	
GORE	CM	INCHES	CM	INCHES	CM	INCHES	CM	INCHES
1	20.3	8	90.8	35-3/4	11.1	4-3/8	206.4	81-1/4
2			91.4	36	11.1	4-3/8	205.7	81
3	20.2	7-7/8	91.4	36	11.3	4-7/16	205.7	81
4	20.2	7-7/8	91.4	36	10.8	4-1/4	↑	↑
5			91.4	36	11.1	4-3/8		
6	20.6	8-1/8	91.4	36	11.1	4-3/8	Not	Not
7			92.1	36-1/4	11.1	4-3/8	Tacked	Tacked
8	20.3	8	91.4	36	11.1	4-3/8	↓	↓
9			92.1	36-1/4	11.4	4-1/2		
10	20.6	8-1/8	92.1	36-1/4	11.1	4-3/8		
11			91.4	36	10.9	4-5/16		
12	20.6	8-1/8	91.4	36	11.1	4-3/8		
13			91.4	36	11.1	4-3/8	205.7	81
14	20.6	8-1/8	91.4	36	11.1	4-3/8	205.7	81
15			91.4	36	11.1	4-3/8	205.7	81
16	20.3	8	92.1	36-1/4	11.1	4-3/8	↑	↑
17			91.4	36	11.1	4-3/8		
18	20.3	8	92.1	36-1/4	11.1	4-3/8	Not	Not
19			91.4	36	11.1	4-3/8	Tacked	Tacked
20	20.2	7-7/8	91.4	36	11.1	4-3/8	↓	↓
21			91.4	36	11.3	4-7/16		
22	20.3	8	91.4	36	10.9	4-5/16		
23			90.8	35-3/4	11.3	4-7/16		
24	20.2	7-7/8	91.4	36	11.1	4-3/8		
25			91.4	36	11.1	4-3/8		
26	20.2	7-7/8	91.4	36	11.3	4-7/16		
27			91.4	36	11.1	4-3/8		
28			90.8	35-3/4	11.3	4-7/16	205.7	81
29			91.4	36	11.1	4-3/8	205.7	81
30			91.4	36	11.3	4-7/16	205.7	81
31			91.4	36	11.4	4-1/2	↑	↑
32			90.8	35-3/4	11.3	4-7/16		
33			90.8	35-3/4	11.3	4-7/16	Not	Not
34			90.8	35-3/4	11.4	4-1/2	Tacked	Tacked
35			90.8	35-3/4	11.4	4-1/2	↓	↓
36			90.8	35-3/4	11.1	4-3/8		
37			91.4	36	11.4	4-1/2		
38			91.4	36	11.4	4-1/2		
39			91.4	36	11.3	4-7/16		
40			91.4	36	11.4	4-1/2	205.7	81
41			91.4	36	11.4	4-1/2	206.4	81-1/4
42			91.4	36	11.3	4-7/16	205.7	81
43			91.4	36	11.4	4-1/2	↑	↑
44			90.8	35-3/4	11.4	4-1/2		
45			91.4	36	11.1	4-3/8	Not	Not
46			91.4	36	10.9	4-5/16	Tacked	Tacked
47			91.4	36	10.9	4-5/16	↓	↓
48			90.8	35-3/4	11.1	4-3/8		
49			91.4	36	11.1	4-3/8		
50			91.4	36	11.1	4-3/8		
51			91.4	36	11.1	4-3/8		
52			90.8	35-3/4	11.1	4-3/8		
53			91.4	36	11.3	4-7/16		
54			90.8	35-3/4	11.4	4-1/2		
TENSION	NO SLACK		5 LBS.		1 LB.		5 LBS.	

F = 26.0 cm (10-1/4 in)

E+F = 225.0 cm (88-5/8 in)

G = 8.6 cm (3-3/8 in)

ACCURACY:

B, D, F measured closest .6 cm (1/4 inch)

A, E+F measured closest .3 cm (1/8 inch)

C, G measured cloest .16 cm (1/16 inch)

Table XII - Linear Dimensions for Parachute P/N 86376-1 S/N 003

GORE	A		B		C		D	
	CM	INCHES	CM	INCHES	CM	INCHES	CM	INCHES
1	20.2	7-7/8	91.4	36	11.1	4-3/8	205.0	80-3/4
2			91.4	36	11.1	4-3/8	205.7	81
3	20.2	7-7/8	91.4	36	11.1	4-3/8	205.7	81
4	20.2	7-7/8	92.1	36-1/4	11.3	4-7/16	↑	↑
5			91.4	36	11.4	4-1/2		
6	20.2	7-7/8	91.4	36	11.3	4-7/16	Not	Not
7			90.8	35-3/4	11.1	4-3/8	Tacked	Tacked
8	20.3	8	90.8	35-3/4	11.3	4-7/16		
9			91.4	36	11.3	4-7/16		
10	20.2	7-7/8	92.1	36-1/4	11.1	4-3/8		
11			91.4	36	11.3	4-7/16		
12	20.2	7-7/8	91.4	36	11.1	4-3/8	↓	↓
13			91.4	36	11.1	4-3/8	205.7	81
14	20.2	7-7/8	91.4	36	11.4	4-1/2	205.4	81-1/4
15			90.8	35-3/4	11.1	4-3/8	205.7	81
16	20.3	8	91.4	36	11.1	4-3/8	↑	↑
17			90.8	35-3/4	11.1	4-3/8		
18	20.2	7-7/8	90.8	35-3/4	11.3	4-7/16	Not	Not
19			90.8	35-3/4	11.1	4-3/8	Tacked	Tacked
20	20.3	8	90.8	35-3/4	11.3	4-7/16		
21			91.4	36	11.1	4-3/8		
22	20.2	7-7/8	90.8	35-3/4	11.1	4-3/8		
23			90.8	35-3/4	11.1	4-3/8		
24	20.2	7-7/8	91.4	36	11.3	4-7/16		
25			90.8	35-3/4	11.4	4-1/2		
26	20.3	8	90.8	35-3/4	11.3	4-7/16		
27			91.4	36	11.3	4-7/16	↓	↓
28			91.4	36	11.3	4-7/16	206.4	81-1/4
29			90.8	35-3/4	11.1	4-3/8	205.7	81
30			90.8	35-3/4	11.3	4-7/16	206.4	81-1/4
31			90.8	35-3/4	11.4	4-1/2	↑	↑
32			91.4	36	11.4	4-1/2		
33			91.4	36	11.3	4-7/16	Not	Not
34			90.8	35-3/4	11.3	4-7/16	Tacked	Tacked
35			90.8	35-3/4	11.4	4-1/2		
36			90.8	35-3/4	11.3	4-7/16		
37			92.1	36-1/4*	11.3	4-7/16		
38			91.4	36	11.3	4-7/16		
39			90.8	35-3/4	11.3	4-7/16	↓	↓
40			91.4	36	11.3	4-7/16	205.7	81
41				36-1/4	11.4	4-1/2	207.0	81-1/4
42			91.4	36	11.3	4-7/16	205.7	81
43			91.4	36	11.3	4-7/16	↑	↑
44			91.4	36	11.1	4-3/8		
45			90.8	35-3/4	11.4	4-1/2		
46			90.8	35-3/4	11.1	4-3/8	Not	Not
47			90.8	35-3/4	11.1	4-3/8	Tacked	Tacked
48			90.8	35-3/4	11.1	4-3/8		
49			90.8	35-3/4	11.3	4-7/16		
50			90.8	35-3/4	11.3	4-7/16		
51			90.8	35-3/4	11.4	4-1/2		
52			91.4	36	11.1	4-3/8		
53			91.4	36	11.3	4-7/16	↓	↓
54			91.4	36	11.1	4-3/8		
TENSION	NO SLACK		5 LBS.		1 LB.		5 LBS.	

* #37 prior to measurement was tensioned to 15 lbs. Measured length at 15 lbs. was 37 inches.

P = 26.0 cm (10-1/4 inches)
E+P = 227 cm (88-3/4 inches)
G = 8.6 cm (3-3/8 inches)

ACCURACY
B, D, E+P, F measured closest .6 cm (1/4 inch)
A measured closest .3 cm (1/8 inch)
G, C measured closest .16 cm (1/16 inch)

For the 86378-1 parachutes, the measurements were taken at the skirt on gores #1, 4, 7 and 10.

A 2 inch diameter test area was used for each measurement. The material was not under any tension at the time of measurement.

Results of the measurements are shown in Table XIII.

5. Conclusions and Recommendations

The following conclusions and recommendations are made concerning the program.

a. A fabrication technique was developed to produce scale parachutes that conform to the drawings. This technique involves use of a tooling aid that allows fabrication of the drag producing surface with a minimum of handling small lengths of ribbon. This tooling aid also allows for quick and accurate placement of the horizontal ribbons with the correct gap.

b. Sufficient dimensional data and porosity measurement were taken on each canopy to interpret the wind tunnel results.

c. This type of fabrication technique is recommended as a guide in fabrication of similar type scale parachutes.

Table XIII - Frasier Diffusion Test Results At A Pressure Differential of 1/2 Inch Water

P/N	S/N	% Porosity
86375-1	001	14.7
	002	13.9
	003	12.4
86376-1	001	22.3
	002	21.8
	003	22.0
86378-1	001	22.9
	002	24.0

APPENDIX A

Drawings of the Scale Drogue Parachute, Pilot Parachute and Deployment Bags.

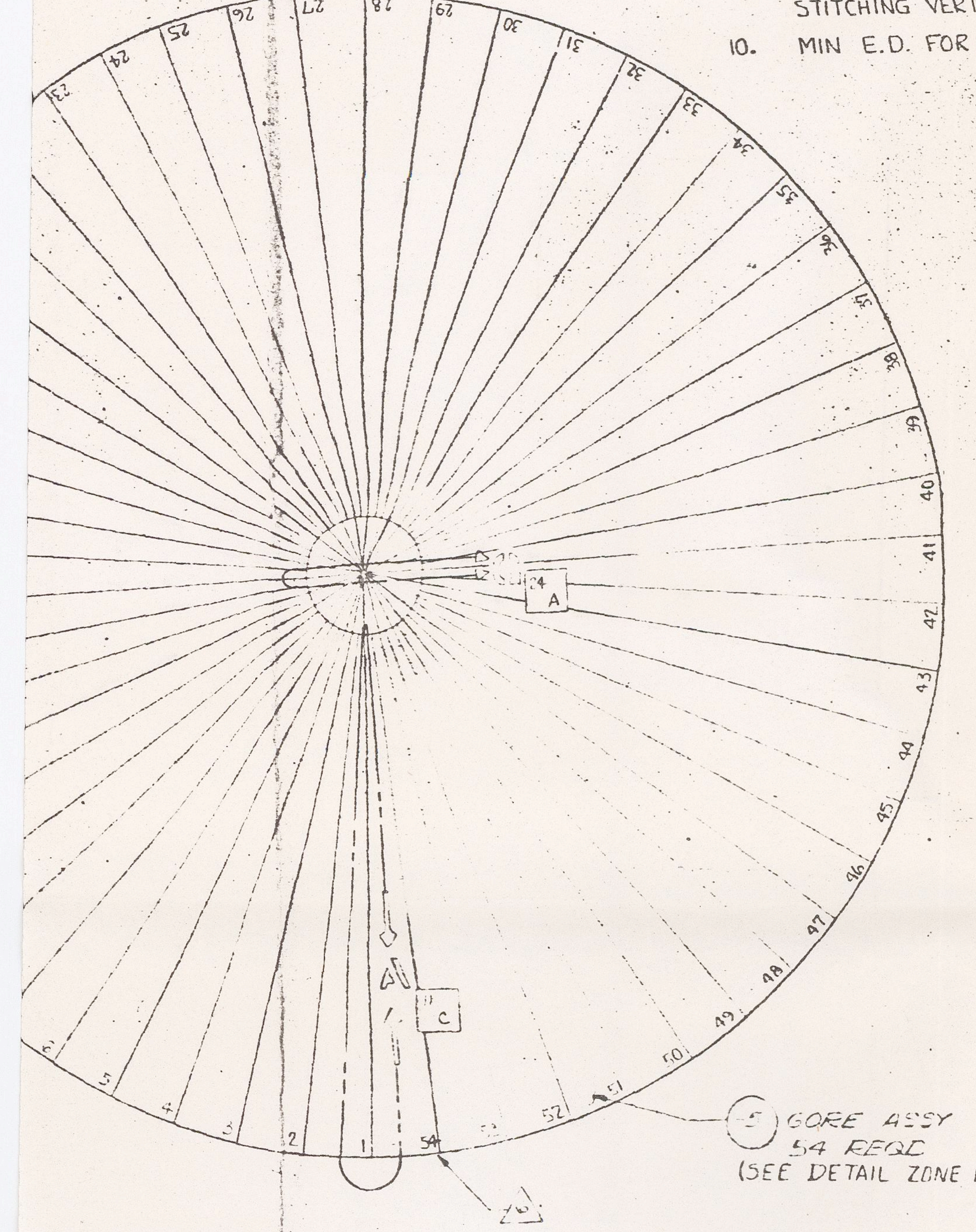
This envelope contains drawing 86375
Parachute Assembly 20° Conical Ribbon,
6.75 Ft Do, 16% porosity.

Note: See tables I and II for modification incorporated into the fabricated parachutes.

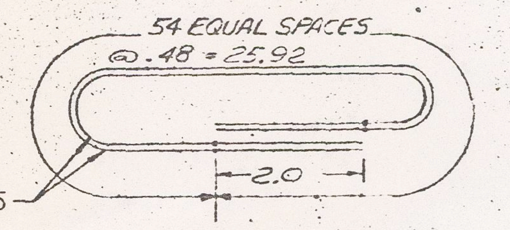
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

NOTES: UNLESS OTHERWISE SPECIFIED

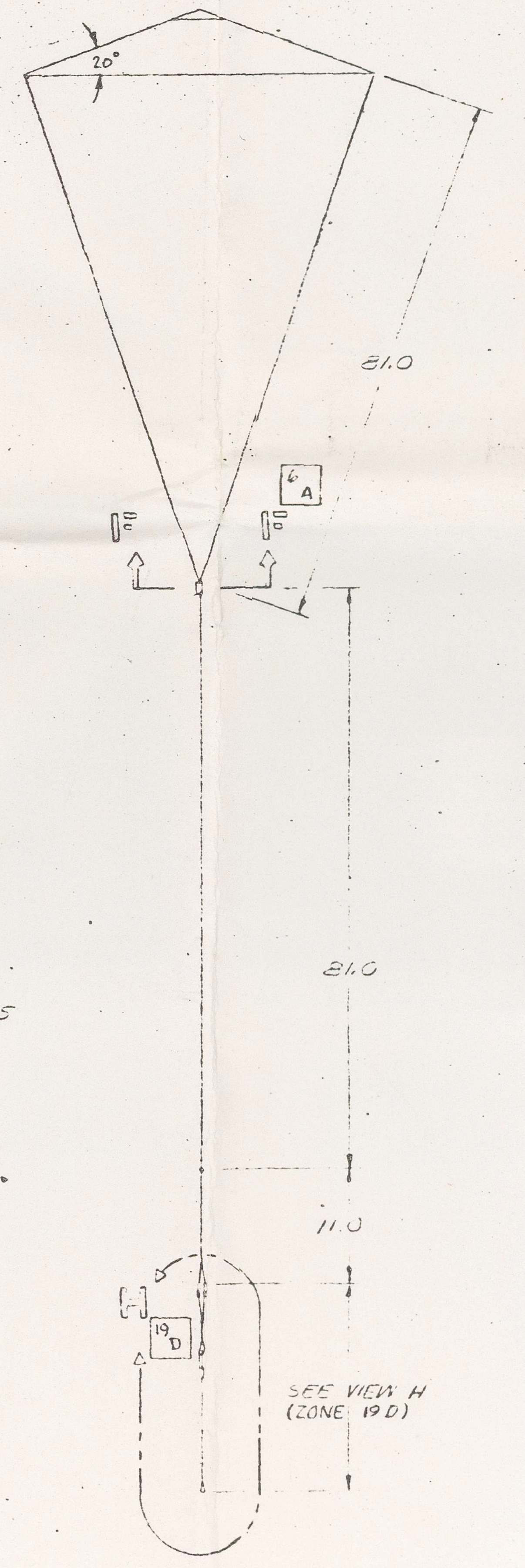
1. STITCHING: SIZE E NYLON THREAD (10 TO 12 STITCHES PER INCH)
2. (flag) COLOR NATURAL
3. CUT ENDS OF TAPES & WEBBINGS ARE TO BE TREATED WITH ANTI-FRAY COATING
4. (flag) SILVER SOLDER ENDS OF SPLIT RING
5. ATTACH IDENTITY TAG TO RISER END. INCLUDE THE FOLLOWING INFORMATION: PART NAME, PART NO., SERIAL NO., DATE OF MFG, AND NAME OF MANUFACTURER. RUBBER STAMP PART NO. AND SERIAL NO. ON GORE 54 (.12 - .25 CHARACTERS)
6. (flag) RUBBER STAMP GORE NO'S NEAR LOWER R.H. CORNER (.12 - .25 CHARACTERS)
7. (flag) THIS IS A FINISHED DIM AND APPLIES AFTER THE SPLICE IS MADE
8. HEAT BASTING WITH HOT NEEDLE IS ACCEPTABLE
9. MASKING TAPE MAY BE USED TO CONTROL HORIZONTAL RIBBON SPACING WHEN STITCHING VERTICALS (TAPE ON ONE SIDE ONLY)
10. MIN E.D. FOR STITCHING OF TAPES AND WEBBINGS .06

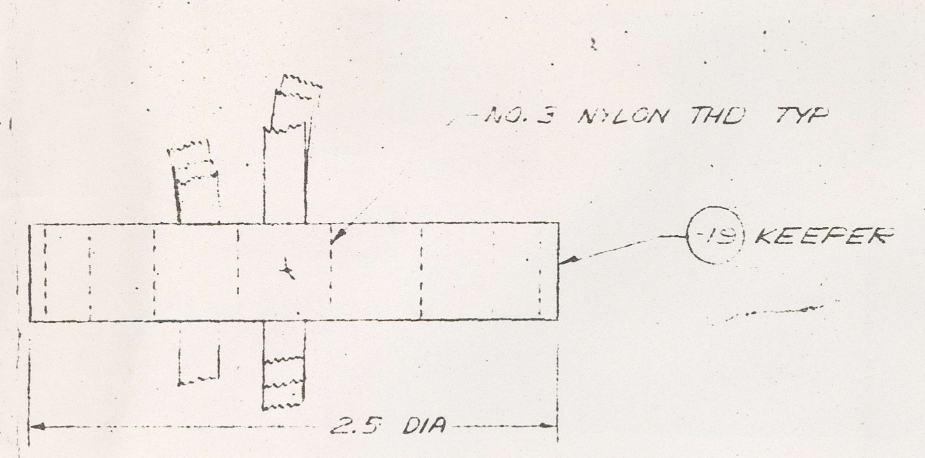


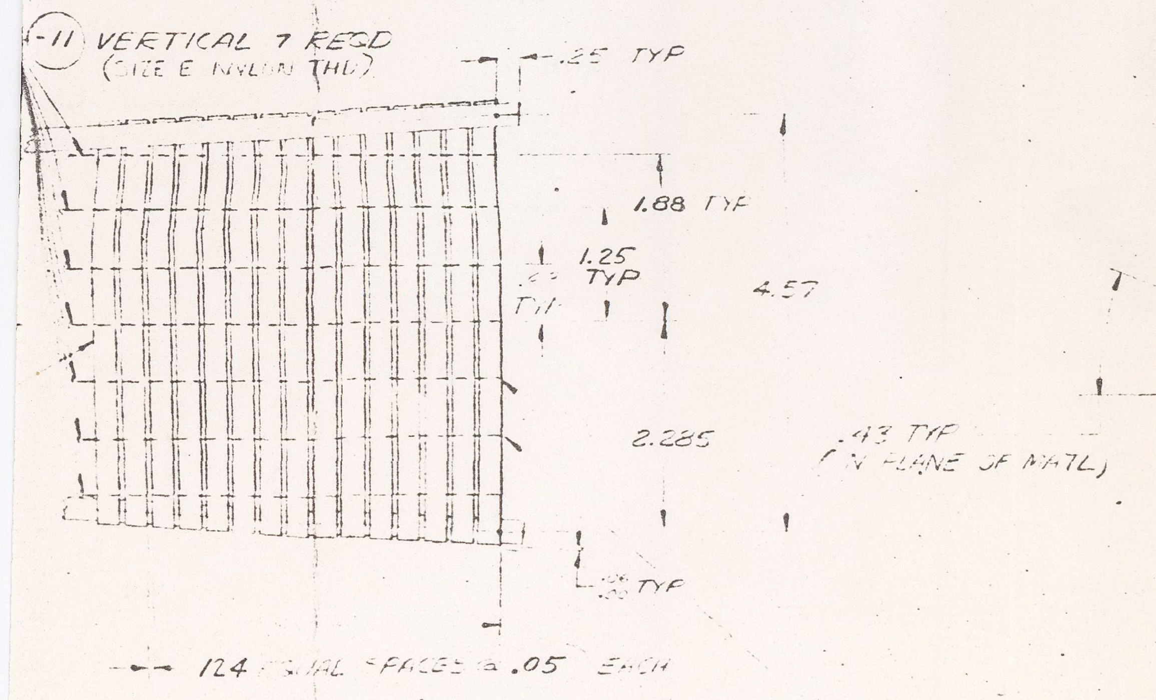
DETAIL -3 CANOPY ASSY

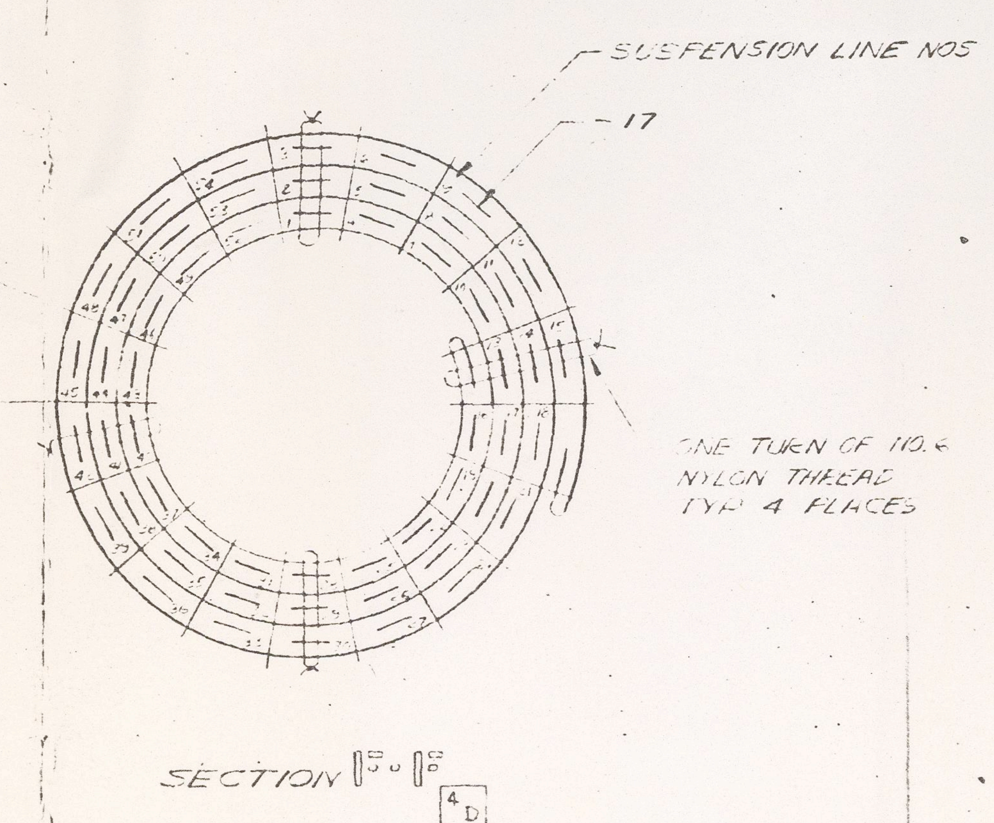


-15 VENT BAND MARKING DIAGRAM
MARK UNDER 5 LBS TENSION
MUST BE MARKED IN PAIRS









SECTION D-D

BACKSTITCH ALL STITCHING SIMULATING VERTICAL TAPES A MIN. OF 0.75 TYP

Flag	-33	-31	-29	-27	-25	-5	-3	-1	CODE IDENT	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	SPECIFICATION	MATERIAL OR NOTE	ZONE	ITEM NO
															34
															33
4								54		NO.6	SPLIT RING STEEL			.14 D	32
								2		101735	LINK	CAPEWELL MFG. CO. HARTFORD, CONN		20 G	31
								1.		MS24553-1	LINK			20 F	30
															29
	AR	AR	AR	AR	AR			AR			THREAD NO.6 CORD	V-T-295 TYPE I CLASS 1	NYLON O.D. OR SAGE GREEN		28
							AR	AR			THREAD NO.3 CORD				27
						AR	AR	AR			THREAD SIZE E				26
															25
															24
															23
															22
															21
															20
															19
2	1	1	1	1						-35	STRAP 1.72 X NOTED	MIL-W-4088 TYPE II	NYLON WEB	20 E	18
								1		-33	RISER			13 D	17
								1		-31	RISER			13 D	16
								1		-29	RISER			13 D	15
								1		-27	RISER			13 D	14
								1		-25	RISER			19 F	13
(flag)								2		-23	BUFFER 1.72 X 2.5	MIL-W-4088 TYPE [illegible]	NYLON WEB	20 G	12
							54			-21	POCKET BAND .25 X 2.5	MIL-T-5608 TYPE I, CL A	NYLON TAPE	14 G	11
								1		-19	KEEPER .50 X 34.5	MIL-T-[illegible]	NYLON TAPE	5 D	10
								27		-17	SUSPENSION LINE 43.0 LG	MIL-C-7515 TYPE XIV	NYLON CORD	11 D	9
							2			-15	VENT BAND .25 X 28.0	MIL-T-5608 TYPE I, CL A	NYLON TAPE	11 H	8
					1					-13	[illegible]	MIL-W-4088 TYPE [illegible]	NYLON WEB	13 F	7
						7				-11	VERTICAL, THREAD SIZE E X NOTED	V-T-295 TYPE I, CL 1	NYLON O.D. OR SAGE GREEN	9 C	6
						2				-9	RADIAL .25 X 38.0	MIL-T-5608 TYPE I, CL A	NYLON TAPE	12 C	5
(flag)						125				-7	HORIZONTAL .25 X NOTED	MIL-T-5608 TYPE I, CL A	NYLON TAPE	16 B	4
							54			-5	GORE ASSY			5 D	3
								1		-3	CANOPY ASSY			5 D	2
															1

REQD PER ASSY — PARTS LIST

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
ANGULAR TOLERANCE ±
LINEAR — HUNDREDTHS ± .030
THOUSANDTHS ± .010
ON SHEET METAL PARTS: ALL BEND RELIEF & INSIDE CORNER RADII .16 OUTSIDE CORNERS .22 RADIUS OPTIONAL. THESE ARE MINIMUM ROUTER REQUIREMENTS.
√ INDICATES SURFACE ROUGHNESS PER USAS B46.1
FABRICATE PER SPEC

CONTRACT NO.		DATE
DRAFTSMAN	L. Pierson	1/22/74
DESIGN APPROVAL	[signature]	2/15/74
STRESS	H. Mullins	2/15/74
CHECK	Jack R. Wilkins	2/16/74
PROJECT OFFICE	Jack R. Wilkins	2/16/74
CUSTOMER APPROVAL		

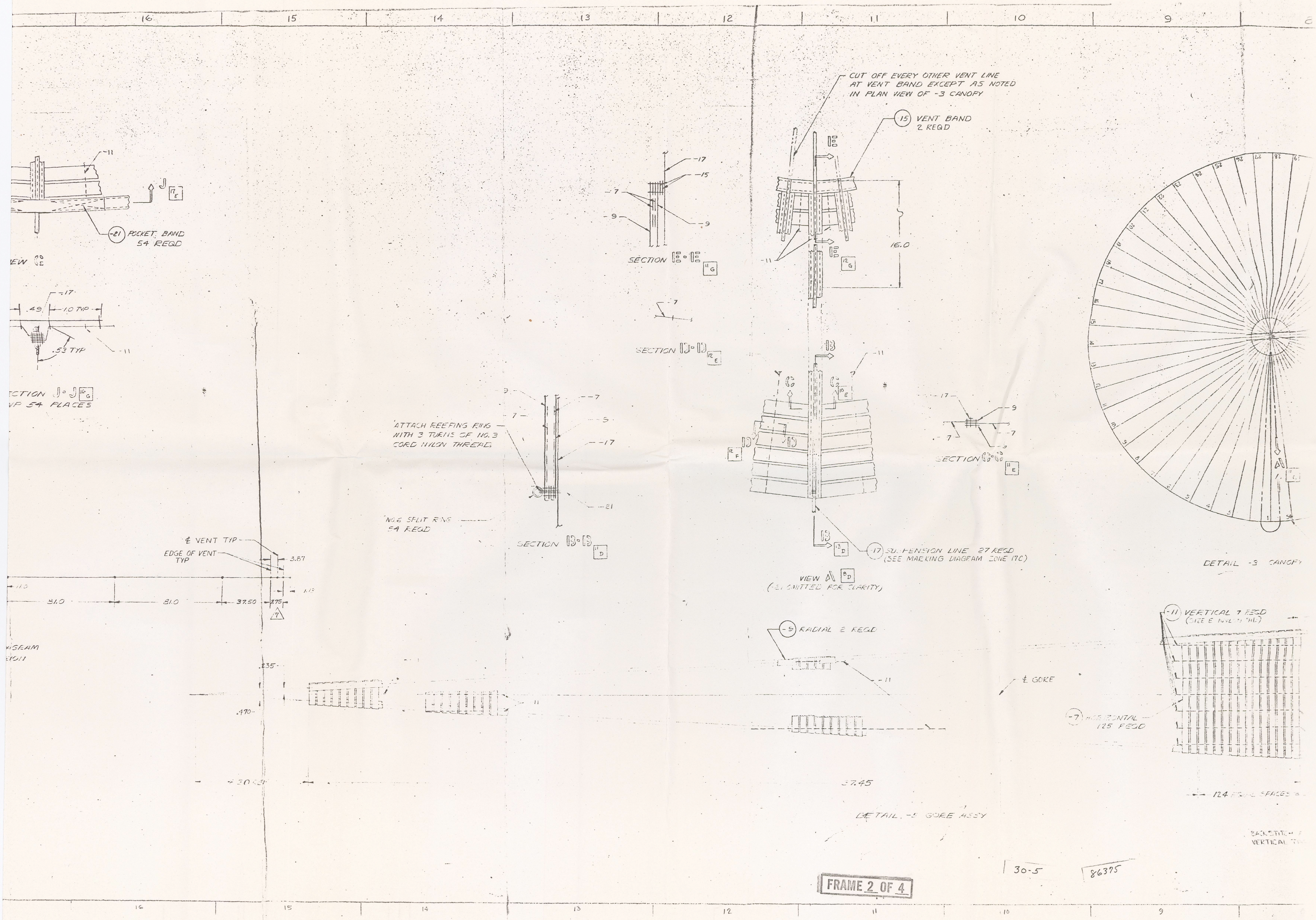
TITLE
PARACHUTE ASSY - 20° CONICAL RIBBON, 6.75 FT D_o, λ_o = 16 %
($\frac{1}{8}$ SCALE OF 54 FT D_o PARACHUTE)

SIZE	CODE IDENT NO.	NO.
J	77646	86375

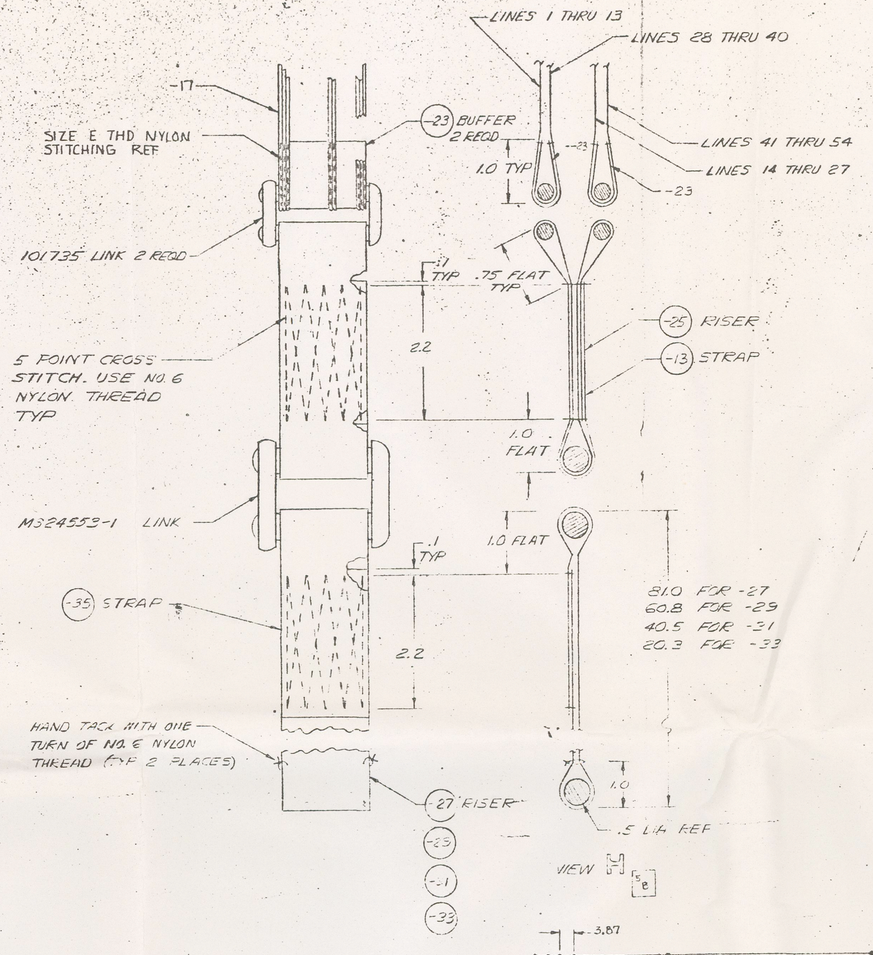
SCALE NONE WT SHEET 1 OF 1

30-5

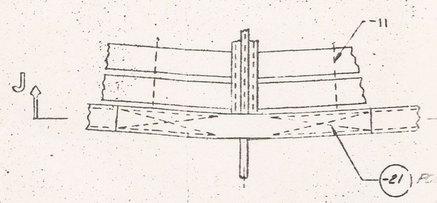
FRAME 1 OF 4



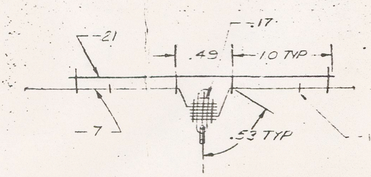
POCKET BAND 54 REQD
VIEW
SECTION J-J TYP 54 PLACES
.49
1.0 TYP
.53 TYP
CUT OFF EVERY OTHER VENT LINE AT VENT BAND EXCEPT AS NOTED IN PLAN VIEW OF -3 CANOPY
VENT BAND 2 REQD
16.0
SECTION E-E
SECTION D-D
ATTACH REEFING RING WITH 3 TURNS OF NO.3 CORD NYLON THREAD
NO.6 SPLIT RING 54 REQD
SECTION B-B
SECTION C-C
SUSPENSION LINE 27 REQD (SEE MARKING DIAGRAM ZONE 17C)
VIEW A
DETAIL -3 CANOPY
℄ VENT TYP
EDGE OF VENT TYP
3.87
81.0
81.0
37.50
.235
.470
RADIAL 2 REQD
℄ GORE
VERTICAL 7 REQD
HORIZONTAL 125 REQD
37.45
124 EQUAL SPACES
DETAIL -5 GORE ASSY
FRAME 2 OF 4
30-5
86375



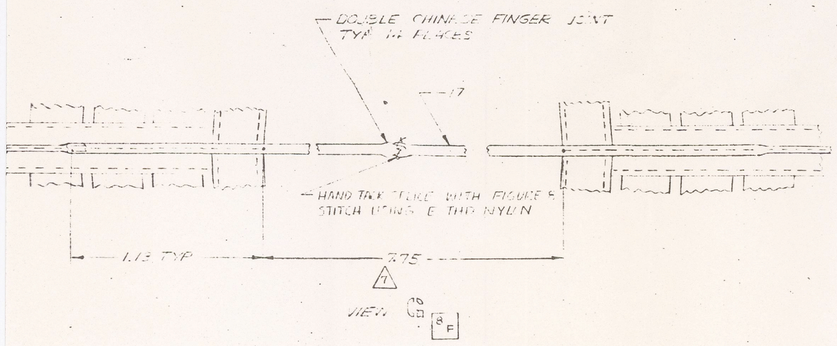
-17 SUSPENSION LINE MARKING DIAGRAM
MARK UNDER 5 LBS TENSION



VIEW G



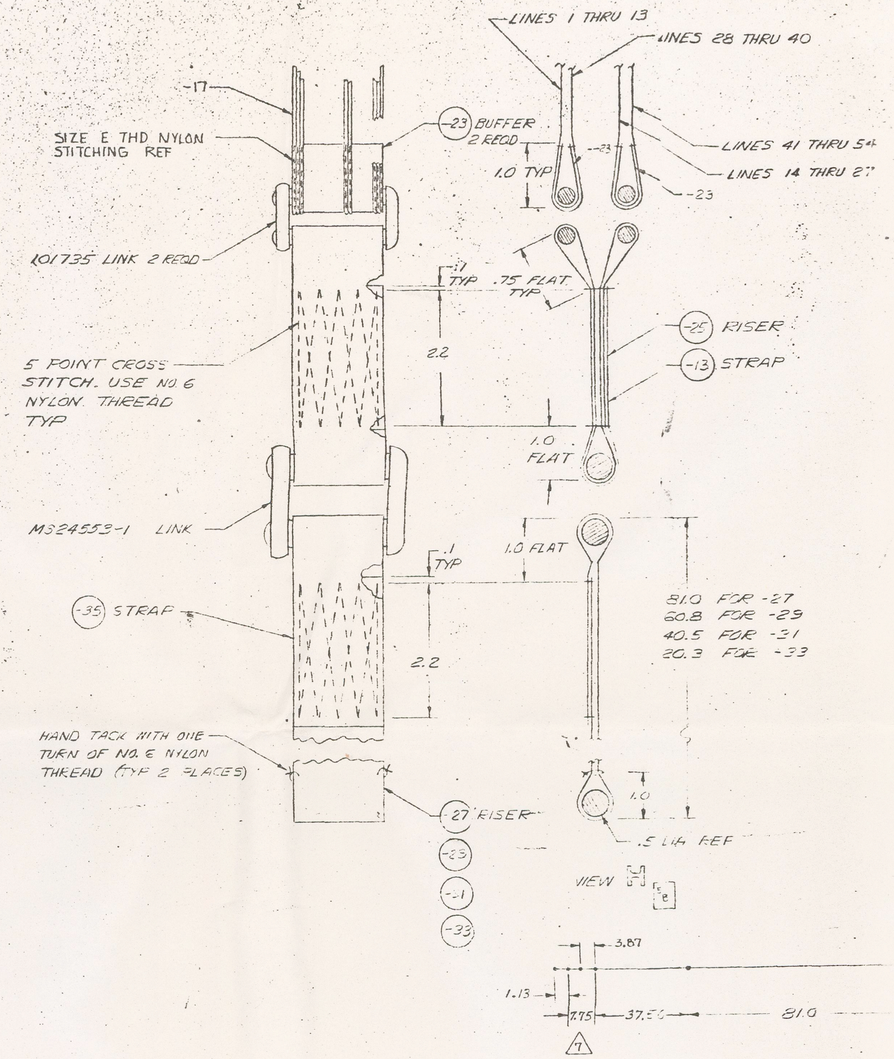
SECTION J-J
TYP 54 PLACES

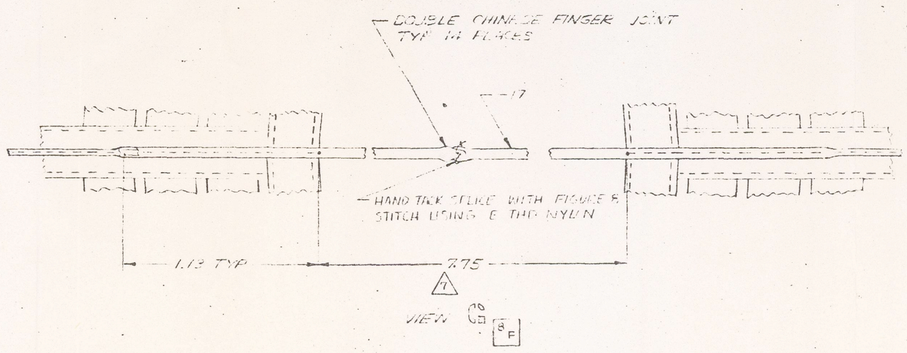


FRAME 3 OF 4

86375

30-5





86395

FRAME 4 OF 4

30-5

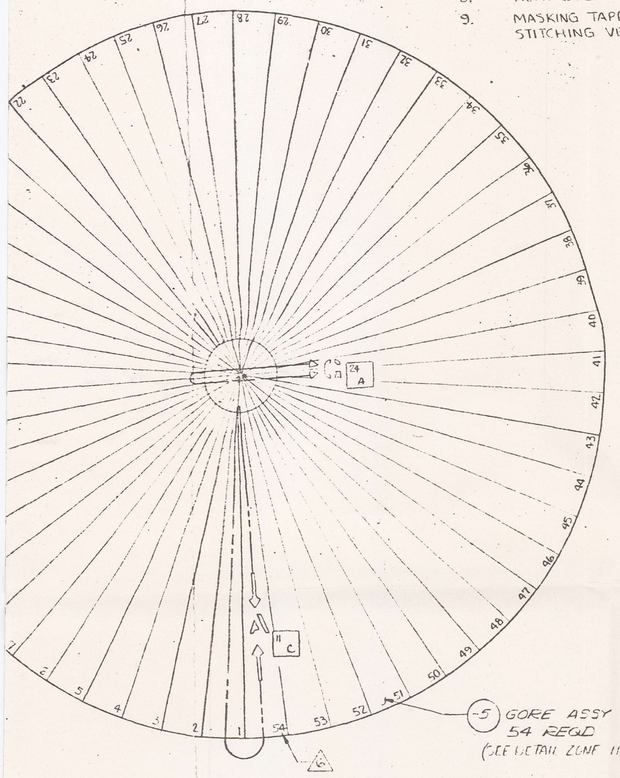
This envelope contains drawing 86376
Parachute Assembly, 20° Conical Ribbon,
6.75 Ft Do, 24% Porosity.

Note: See table III for modifications incorporated into the fabricated parachutes.

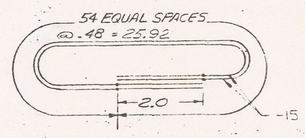
NOTES: UNLESS OTHERWISE SPECIFIED

1. STITCHING: SIZE E NYLON THREAD (10 TO 12 STITCHES PER INCH)
2. COLOR NATURAL
3. CUT ENDS OF TAPES & WEBBINGS ARE TO BE TREATED WITH ANTI-FRAY COATING
4. SILVER SOLDER ENDS OF SPLIT RING
5. ATTACH IDENTITY TAG TO RISER END. INCLUDE FOLLOWING INFORMATION: PART NAME, PART NO., SERIAL NO., DATE OF MFG, AND NAME OF MANUFACTURER. RUBBER STAMP PART NO. AND SERIAL NO. ON GORE 54 (.12 - .25 CHARACTERS)
6. RUBBER STAMP GORE NO'S NEAR LOWER R. H. CORNER (.12 - .25 CHARACTERS)
7. THIS IS A FINISHED DIM AND APPLIES AFTER THE SPLICE IS MADE
8. HEAT BASTING WITH HOT NEEDLE IS ACCEPTABLE
9. MASKING TAPE MAY BE USED TO CONTROL HORIZONTAL RIBBON SPACING WHEN STITCHING VERTICALS (TAPE ON ONE SIDE ONLY)
10. MIN E.D. FOR STITCHING OF TAPES AND WEBBINGS .06

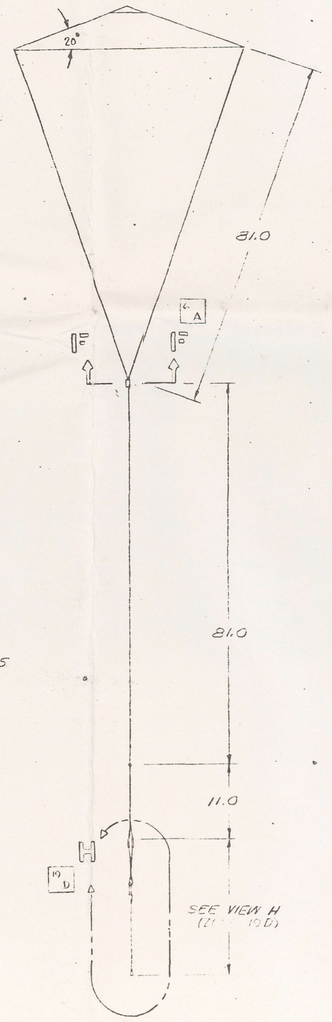
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

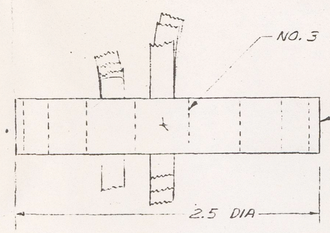


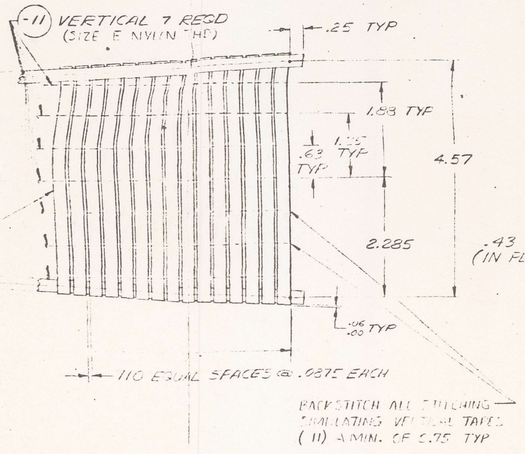
DETAIL -3 CANOPY ASSY

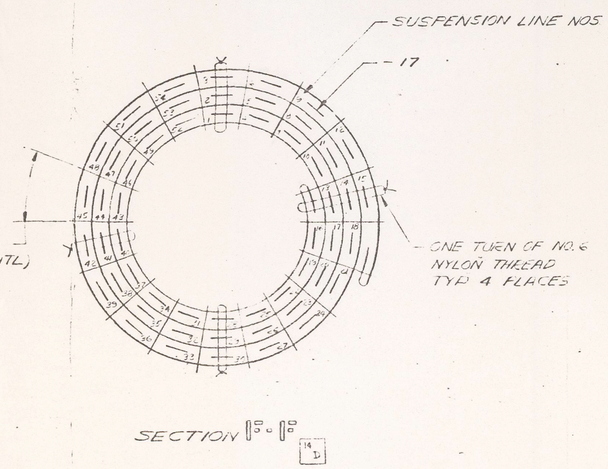


-15 VENT BAND MARKING DIAGRAM
MARK UNDER 5 LBS TENSION
MUST BE MARKED IN PAIRS









ITEM NO.	ZONE	MATERIAL OR NOTE	SPECIFICATION	NOMENCLATURE OR DESCRIPTION	PART OR IDENTIFYING NO.	CODE IDENT	REQD PER ASSY
34							
33							
32	4 D			SPLIT RING STEEL	NO.6		54
31	20 G	MFG. CO. CONN	CAPEWELL HARTFORD	LINK	101735		2
30	20 F			LINK	MS24553-1		1
29							
28				THREAD NO.6 CORD		AR	AR AR AR AR AR
27		NYLON O.D. OR SAGE GREEN	V-T-295 TYPE I CLASS 1	THREAD NO.3 CORD		AR	AR AR
26				THREAD SIZE E		AR	AR AR
25							
24							
23							
22	D						
21							
20							
19							
18	20 E	NYLON WEB	MIL-W-4088 TYPE II	STRAP 1.75 X NOTE 1	-35		1 1 1 1
17	19 D			RISER	-33		1
16	19 D			RISER	-31		1
15	19 D			RISER	-29		1
14	19 D			RISER	-27		1
13	19 F			RISER	-25		1
12	20 G	NYLON WEB	MIL-W-4088 TYPE II	BUFFER 1.75 X 2.5	-23		2
11	16 G	NYLON TAPE	MIL-T-5038 TYPE II CLA	POCKET BAND .25 X 2.5	-21		54
10	5 D	NYLON TAPE	MIL-T-2283	KEEPER .50 X 3.40	-19		1
9	11 D	NYLON CORD	MIL-C-7515 TYPE XIV	SUSPENSION LINE 439.0 LB	-17		27
8	11 H	NYLON TAPE	MIL-T-5038 TYPE II CLA	VENT BAND .25 X 38.0	-15		2
7	13 F	NYLON WEB	MIL-W-4088 TYPE VI	RADIAL 1.75 X NOTE 1	-13		1
6	5 C	NYLON TAPE OR SAGE GREEN	MIL-T-5608 TYPE I	VERTICAL THREAD .125 E NYLON	-11		7
5	12	NYLON TAPE	MIL-T-5608 TYPE I CLA	RADIAL .25 X 38.0	-9		2
4	10 E	NYLON TAPE	MIL-T-5608 TYPE I CLA	HORIZONTAL .25 X NOTE 1	-7		111
3	8 D			GORE ASSY	-5		54
2	8 D			CANOPY ASSY	-3		1
1							

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	CONTRACT NO.		
ANGULAR TOLERANCE LINEAR — HUNDREDTHS ± .030 THOUSANDTHS ± .010		DATE	
ON SHEET METAL PARTS: ALL BEND RELIEFS INSIDE CORNER RAIM 16 OUTSIDE CORNERS 2L RADIUS OR IONAL THESE ARE MINIMUM ROUTER REQUIREMENTS	DRAFTSMAN L. Pierson	11/5/74	PARACHUTE ASSY - 20° CONICAL RIBBON, 6.75 FT Do, Ag = 27.7% (1/8 SCALE OF 54FT Do PARACHUTE)
	DESIGN APPROVAL	11/5/74	
	STRESS	11/6/74	
INDICATES SURFACE ROUGHNESS PER USAS B46.1	CHECK	11/6/74	
	PROJECT OFFICE	11/6/74	SIZE J CODE IDENT NO. 77646 NO. 26277
NEXT ASSY USED ON	CUSTOMER APPROVAL		SCALE WT SHEET 1 OF 1
APPLICATION	FABRICATE PER SPEC		

FRAME 1 OF 4

-11

J J 17 E

-21 POCKET BAND 54 REQD

EW J J

-17

.49 1.0 TYP

.53 TYP

-11

CTION J-J 16 G
YP 54 PLACES

-17
-15
-7
-9

SECTION 10-10 11 G

-7

SECTION 11-11 12 E

CUT OFF EVERY OTHER VENT LINE AT VENT BAND EXCEPT AS NOTED IN PLAN VIEW OF -3 CANOPY

-15 VENT BAND 2 REQD

16.0

-11

12 G

-11

13 13

15 E

-11

12 F

13

15 D

-17 SUSPENSION LINE 27 REQD (SEE MARKING DIAGRAM ZONE 17C)

VIEW A 8 D
(-21 OMITTED FOR CLARITY)

-17
-9
-7
-7
-9

SECTION 13-13 11 E

-9
-7
-7
-17

ATTACH REEFING RING WITH 3 TURNS OF NO. 3 CORD NYLON THREAD

-21

NO.6 SPLIT RING 54 REQD

SECTION 13-13 11 D

DETAIL -3 CANOPY

E OF VENT TYP
EDGE OF VENT TYP

4.00

11.0 81.0 81.0 37.43 8.00 1.13

7

AGRAM
EW

-11 VERTICAL 7 REQD (SIZE E NYLON TAPE)

-9 *RADIAL 2 REQD

-11

.240

.480

-11

-11

℄ GORE

-7 HORIZONTAL 11 REQD

4.38 REF

37.37

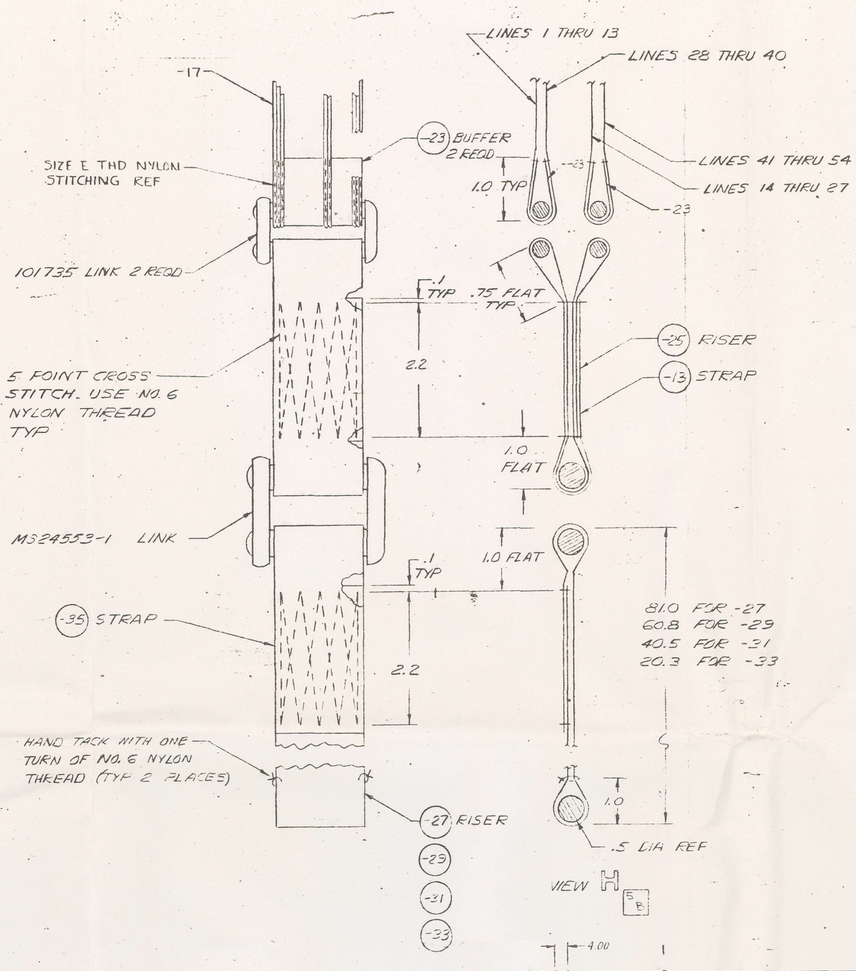
110 EQUAL SPACES

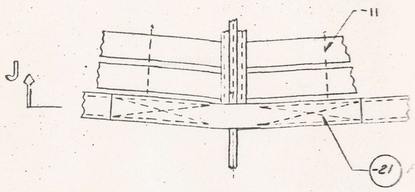
DETAIL -5 GORE ASSY

FRAME 2 OF 4

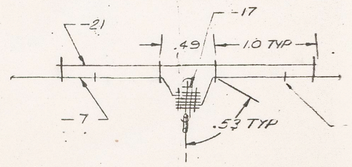
86376

30-5



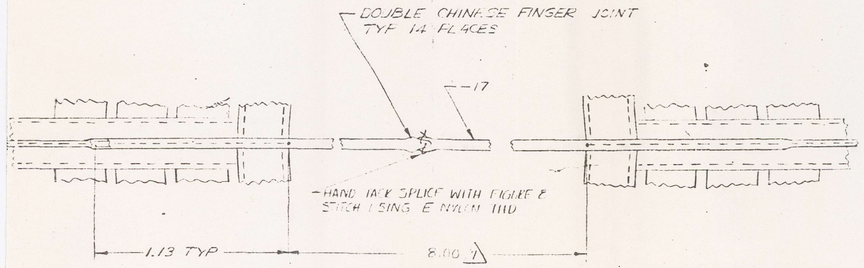


VIEW J



SECTION J-J 16 G
TYP 54 PLACES

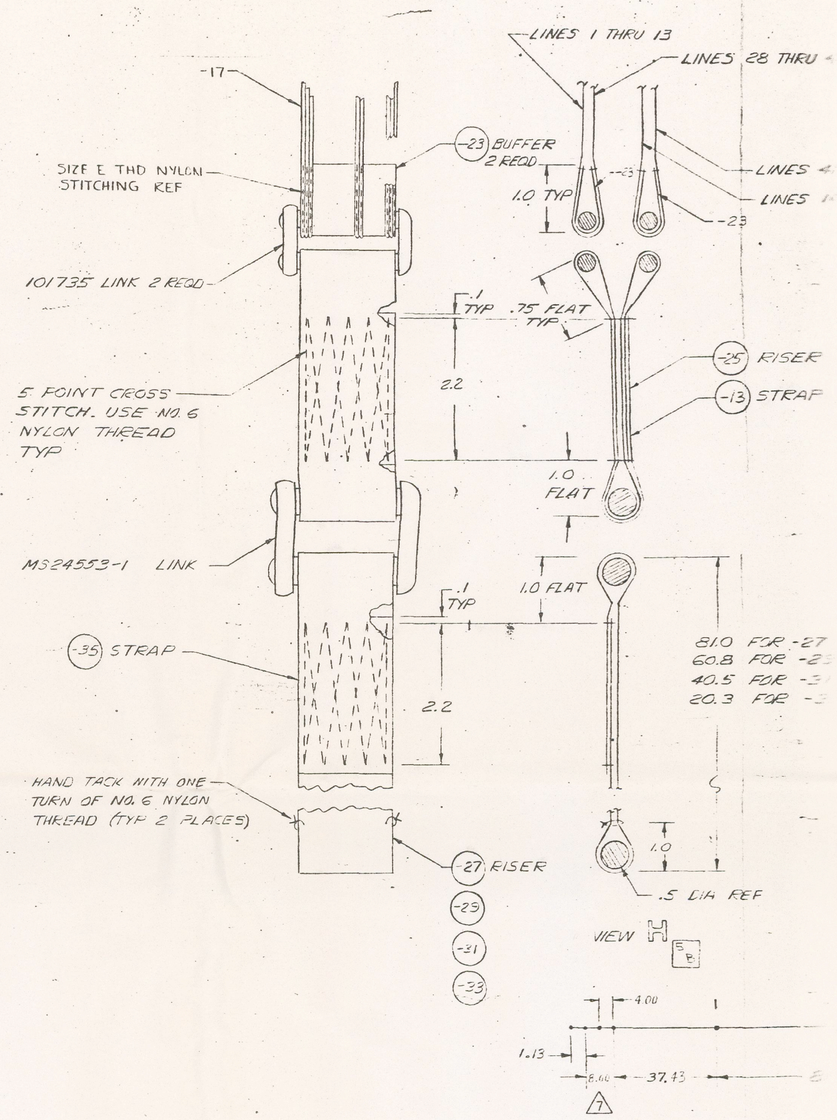
-17 SUSPENSION LINE MARKING DIAGRAM
MARK UNDER 5 LBS TENSION

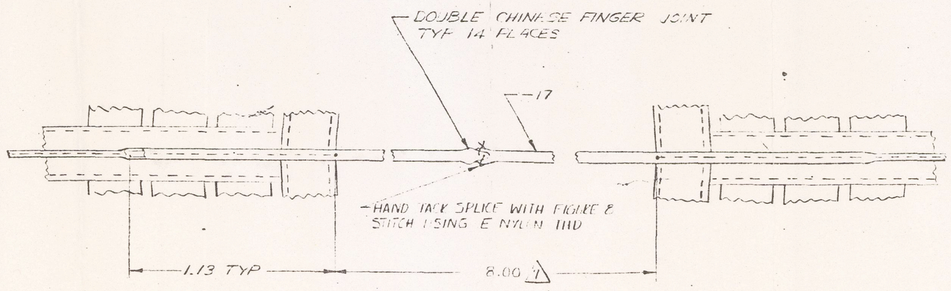


VIEW K

30-5

86376





FRAME 4 OF 4

30-5

86376

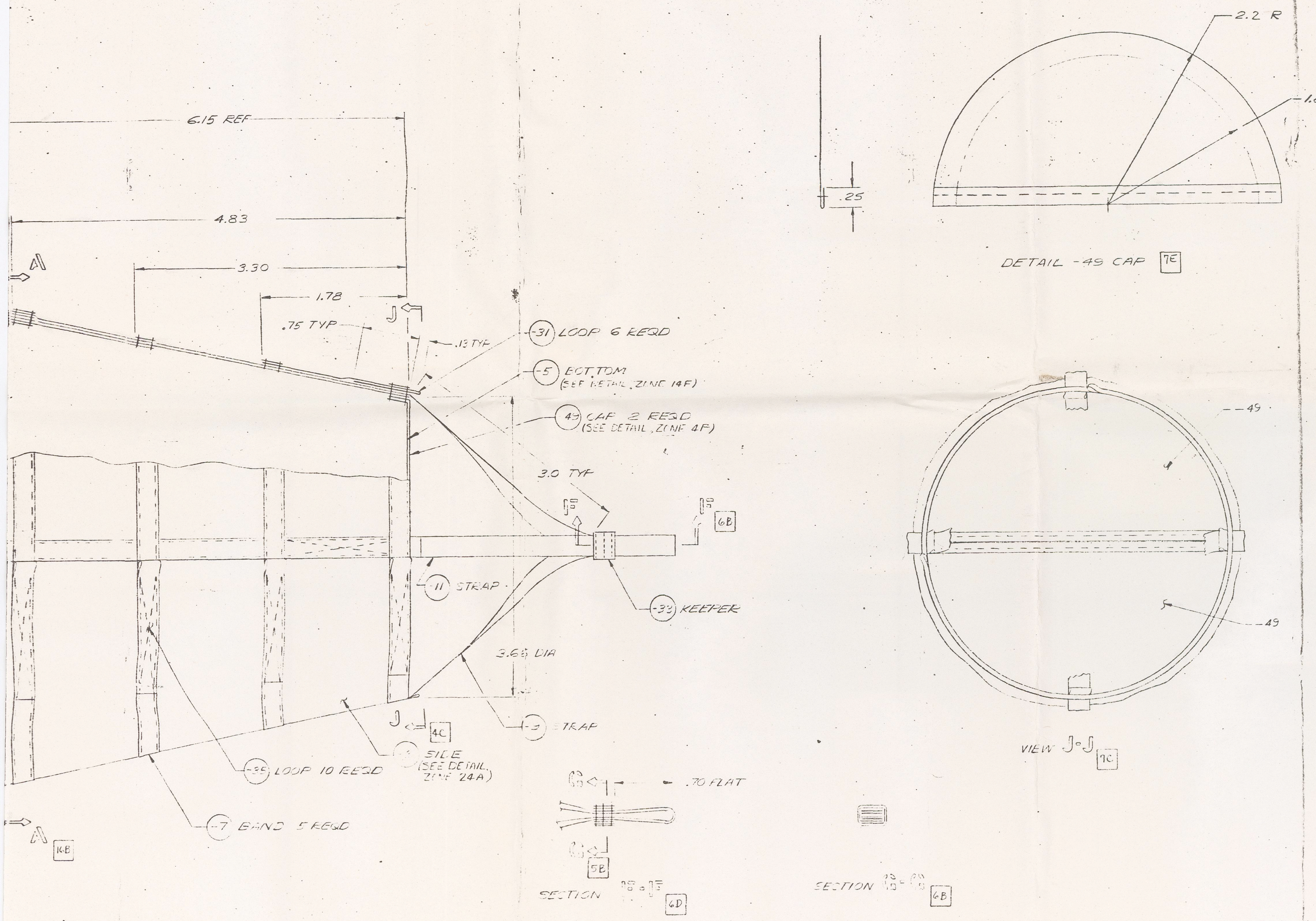
This envelope contains drawing 86377

Deployment Bag, Drogue Parachute

Note: See Table IV for modifications incorporated into the fabricated parachutes.

NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL STITCHING TO BE SIZE FF NYLON THREAD (7 TO 11 STITCHES PER INCH)
2. (△) COLOR OPTIONAL
3. (△) USE CONTRASTING COLOR THREAD WHERE POSSIBLE
4. (△) LOOSE ITEM
5. (△) MIL-C-557, TYPE I COTTON CLOTH OPTIONAL. MILDEW PROOFING PER CCC-950, CLASS I IS DESIRABLE BUT NOT REQD OF EITHER MATERIAL.
6. MIN E.D. FOR STITCHING OF TAPES AND WEBBINGS .06
7. RUBBER STAMP THE FOLLOWING ON OUTSIDE OF BAG IN .12-.25 CHARACTERS: PART NAME, PART NO., SERIAL NO., DATE OF MFG, NAME OF MANUFACTURER



-39	-1	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	SPECIFICATION	MATERIAL OR NOTE	ZONE	ITEM NO.
42	AR			THREAD SIZE FF	V-T-295 TYPE I CLASS I	NYLON		34
	AR			THREAD SIZE E				33
								32
								31
								30
								29
								28
								27
								26
	2		-49	CAP 3.5 X 4.5	MIL-C-10296 CLASS I	COTTON CLOTH	7E	25
1			-47	LINE 120.0	MIL-C-7515 TYPE II	NYLON CORD	26F	24
1			-45	KEEPER .50 X 3.5	MIL-T-5038 TYPE III	NYLON TAPE	24F	23
1			-43	STRAP .50 X 14.5	MIL-T-5038 TYPE III	NYLON TAPE	23G	22
1			-41	STRAP .50 X [illegible]	MIL-T-5038 TYPE III	NYLON TAPE	23G	21
	1		-39	BRIDLE ASSY			24F	20
	1		-37	LOOP .375 X 6.7	MIL-T-5661 TYPE I	COTTON TAPE	12B	19
	10		-35	LOOP .375 X 3.8	MIL-T-5038 TYPE III	NYLON TAPE	8E	18
	1		-33	KEEPER .375 X 3.6	MIL-T-5038 TYPE III	NYLON TAPE	6D	17
	6		-31	LOOP .375 X NOTED	MIL-T-5038 TYPE III	NYLON TAPE	7E	16
	1		-29	STRAP .375 X 6.2	MIL-T-5038 TYPE III	NYLON TAPE	[illegible]	15
	1		-27	STRAP .375 X 7.7	MIL-T-5038 TYPE III	NYLON TAPE	22D	14
	1		-25	LOOP .375 X 4.6	MIL-T-5661 TYPE I	COTTON TAPE	22C	13
	1		-23	SLEEVE 6.1 X 20.5	MIL-C-10296 CLASS I	COTTON CLOTH	11E	12
	1		-21	FLAP 3.8 X 4.4	↕	↕	15B	11
	1		-19	FLAP 3.8 X 4.4			15E	10
	1		-17	SLEEVE 5.1 X 19.0			15E	9
	1		-15	FLAP 4.1 X 4.8			14C	8
	1		-13	FLAP 4.1 X 4.8	MIL-C-10296 TYPE I	COTTON CLOTH	11E	7
	1		-11	STRAP .375 X 31.0	MIL-T-5038 TYPE III	NYLON TAPE	7D	6
	1		-9	STRAP .375 X 22.5	MIL-T-5038 TYPE III	NYLON TAPE	7C	5
	5		-7	BAND .375 X NOTED	MIL-T-5038 TYPE III	NYLON TAPE	8B	4
	1		-5	BOTTOM 4.5 X 4.5	MIL-C-10296 CLASS I	COTTON CLOTH	7E	3
	1		-3	SIDE 9.0 X 20.0	MIL-C-10296 CLASS I	COTTON CLOTH	7C	2
								1

REQD PER ASSY — PARTS LIST

Notes flagged in the left margin: items 34, 33 — △3 △2; items 25 to 2 — △2; item 20 — △4; items 12 to 8 and 3 — △5; item 2 — △5 △2.

REVISIONS: ZONE | LTR | DESCRIPTION | DATE | APPROVED

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
ANGULAR TOLERANCE ±
LINEAR — HUNDREDTHS ± .030
THOUSANDTHS ± .010
ON SHEET METAL PARTS: ALL BEND RELIEF & INSIDE CORNER RADII .16. OUTSIDE CORNERS .22 RADIUS OPTIONAL. THESE ARE MINIMUM ROUTER REQUIREMENTS
INDICATES SURFACE ROUGHNESS PER USAS B46.1
FABRICATE PER SPEC

NEXT ASSY | USED ON — APPLICATION

CONTRACT NO.
DRAFTSMAN L. Parson 1/31/74
DESIGN APPROVAL
STRESS
CHECK
PROJECT OFFICE
CUSTOMER APPROVAL

TITLE: DEPLOYMENT BAG - DROGUE PARACHUTE, (1/8 SCALE OF 54' Do PARACHUTE)

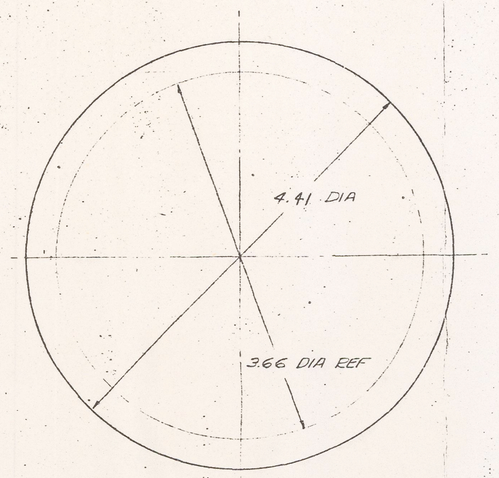
SIZE J | CODE IDENT NO. 77646 | NO. 86377
SCALE NONE | WT | SHEET | OF

86377

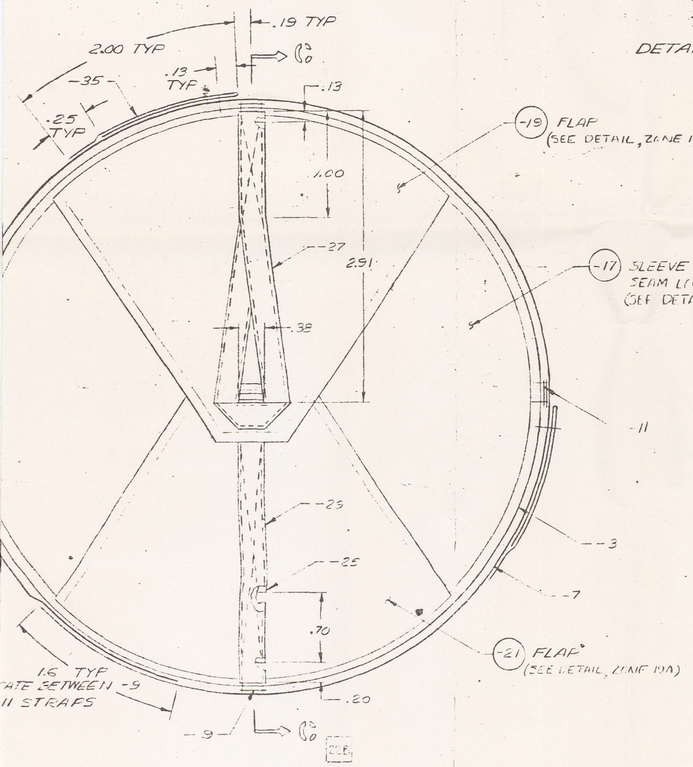
86377 BAG

30-5

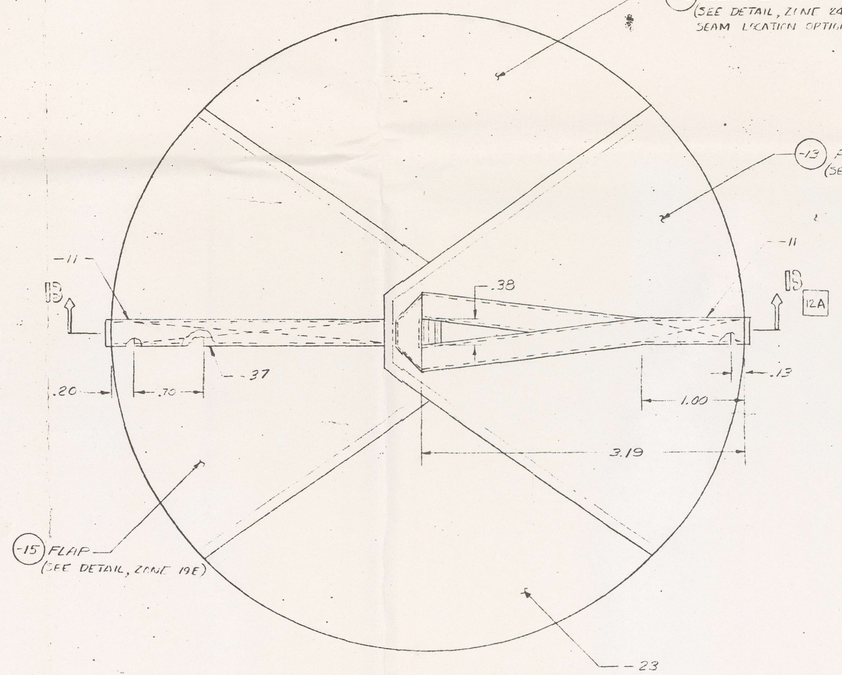
FRAME 1 OF 4

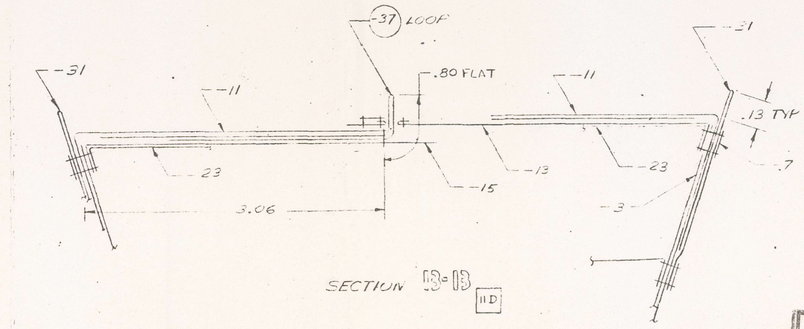


DETAIL -5 BOTTOM 7E

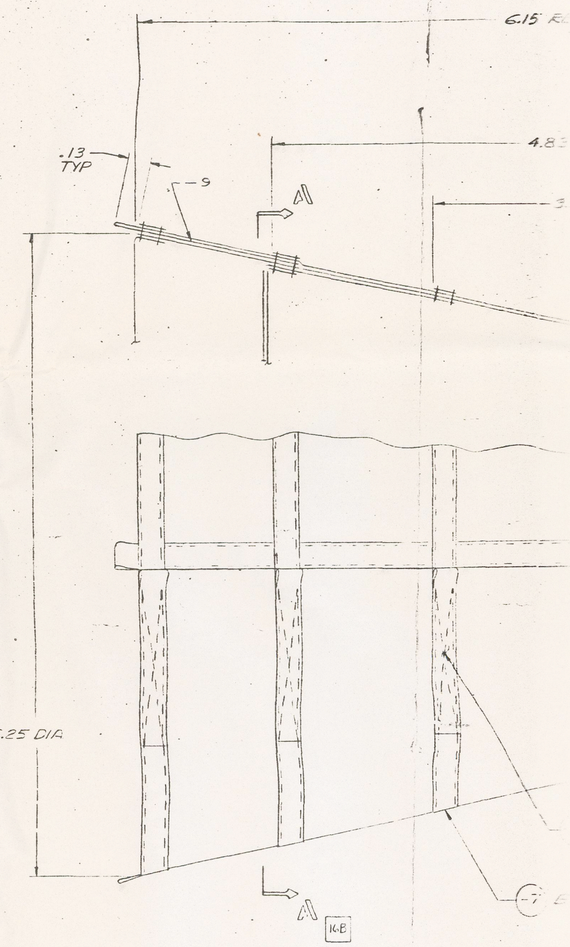


SECTION A-A 9C





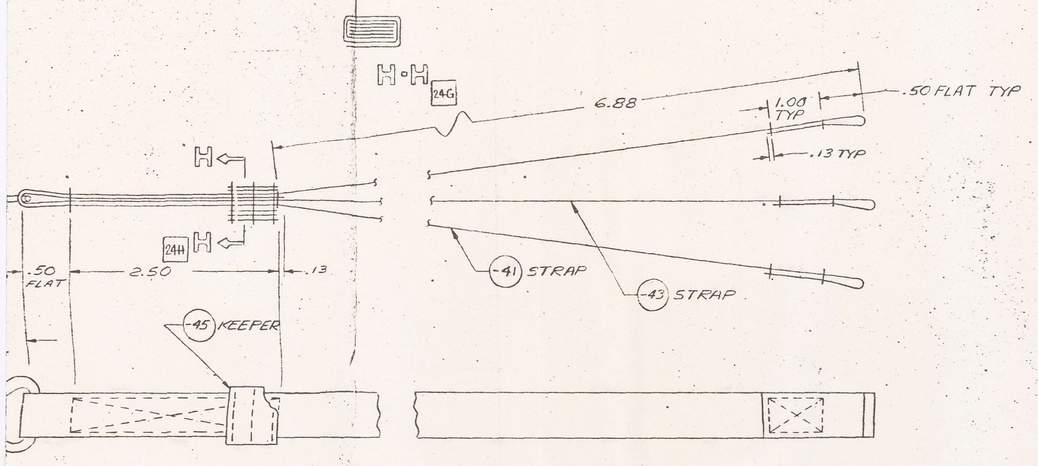
SECTION B-B 11D



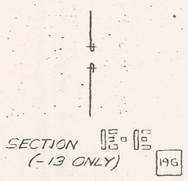
30-5

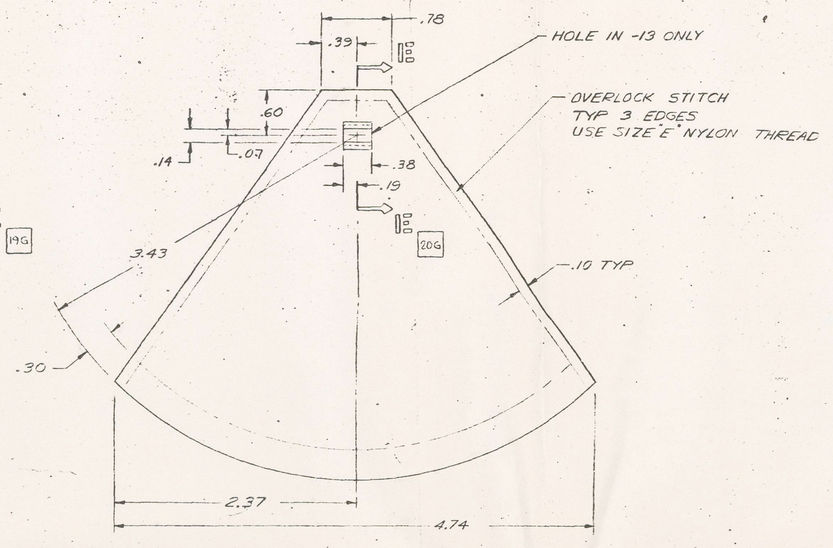
86377

FRAME 2 OF 4

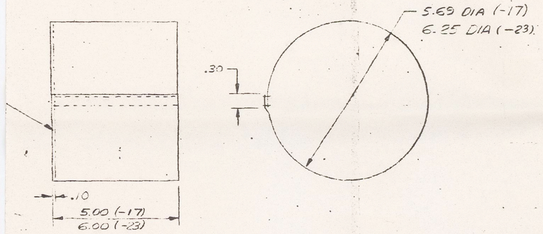


DETAIL -39 BRIDLE ASSY

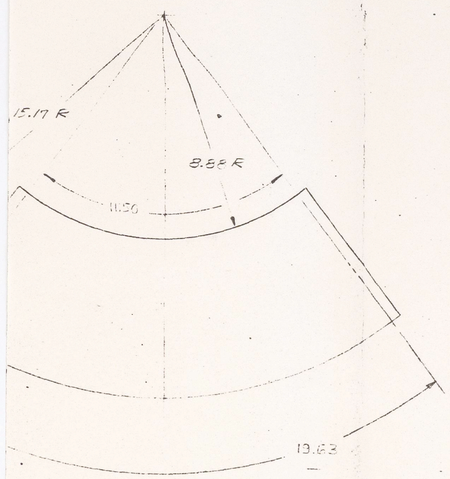




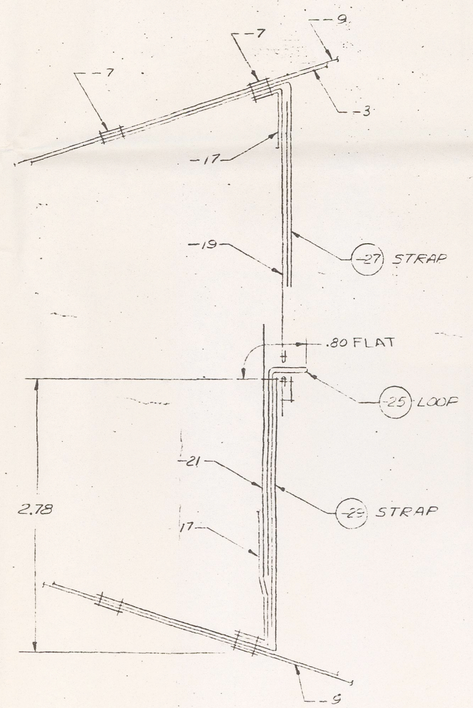
DETAIL -13 & -15 FLAP
11E 13E



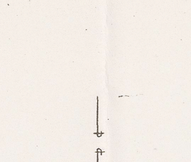
DETAIL -17 & -23 SLEEVE
14D 11E

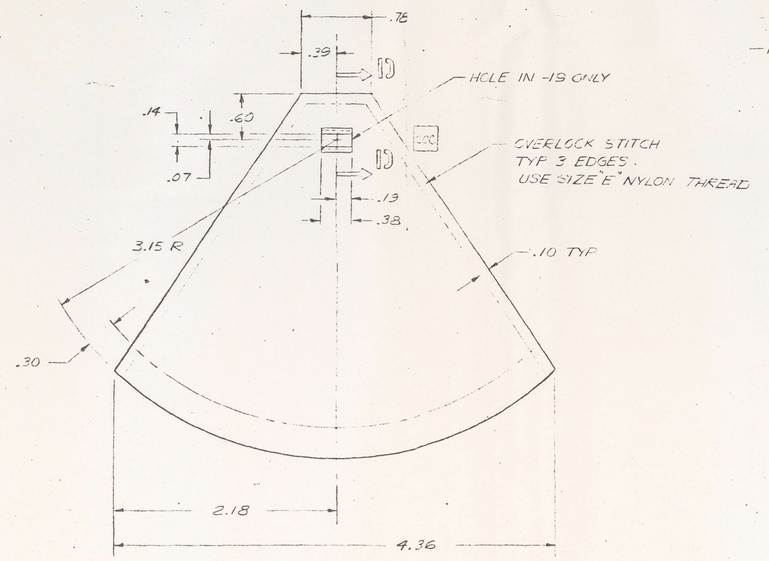


DETAIL -9 SIDE
7C

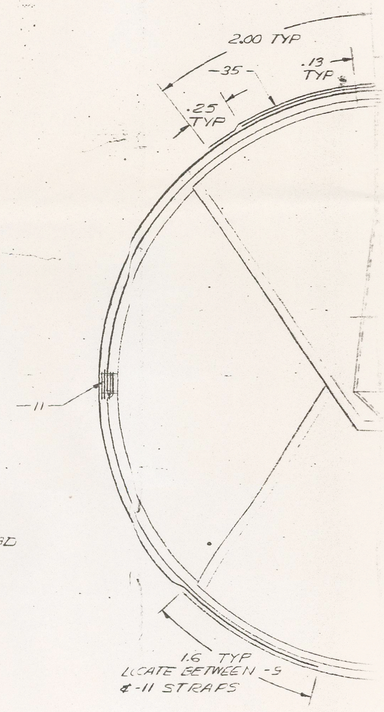


SECTION
16E





DETAIL -19 & -21 FLAP
15E 15B

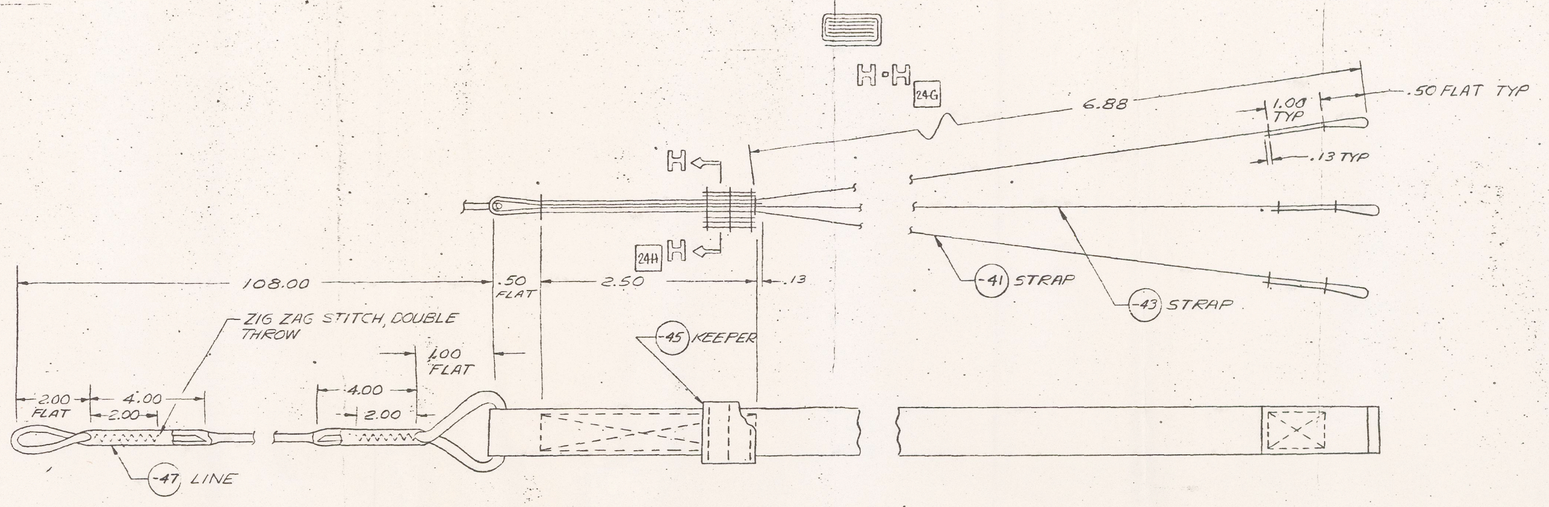


SECTI

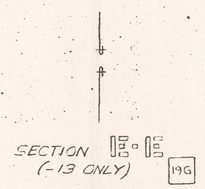
86377

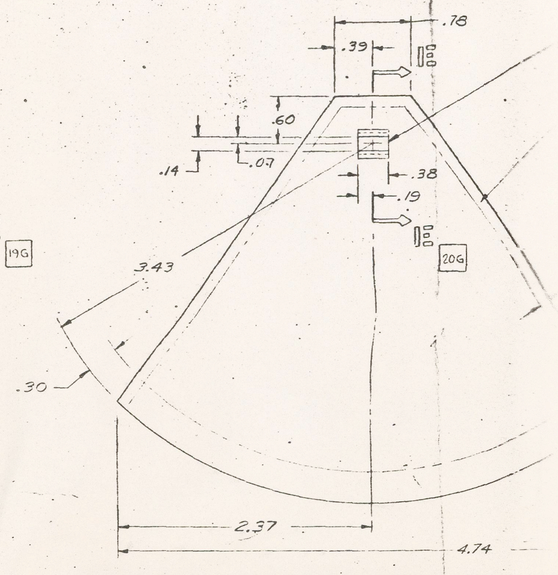
FRAME 3 OF 4

30-5

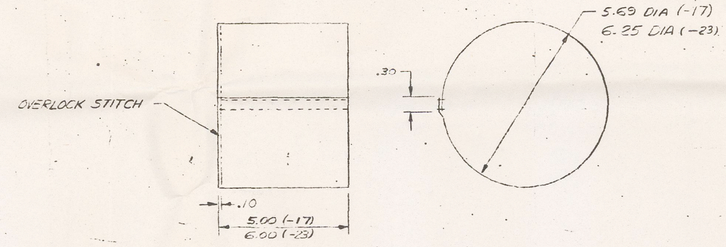


DETAIL -39 BEIDLE ASSY

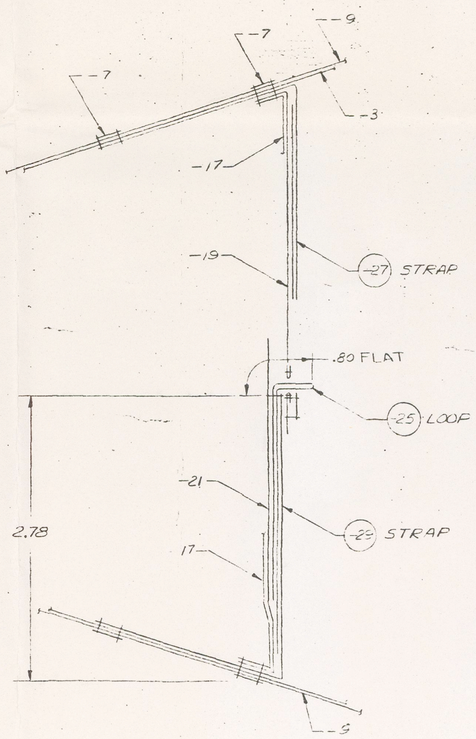




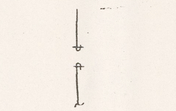
DETAIL -13 & -15 FLAP 18E

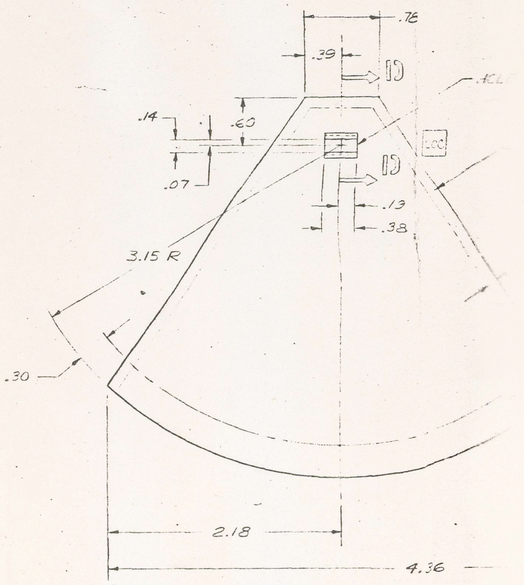


DETAIL -17 & -23 SLEEVE 14D 18E

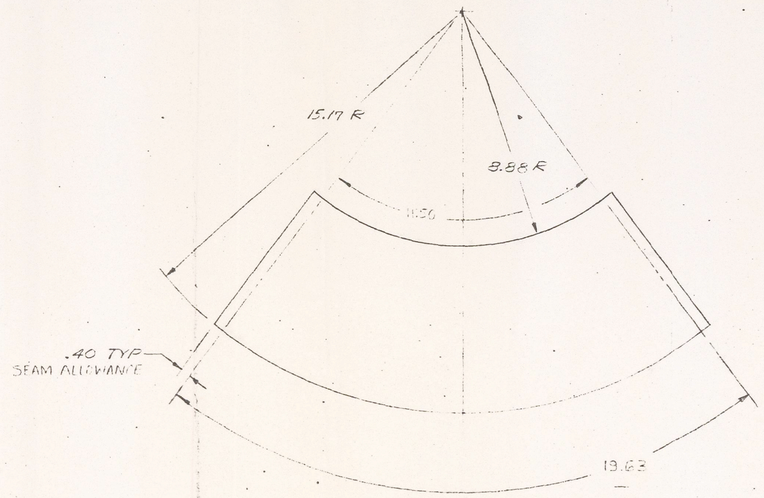


SECTION C-C 18E





DETAIL -19 & -21 FLAP 18E 18D



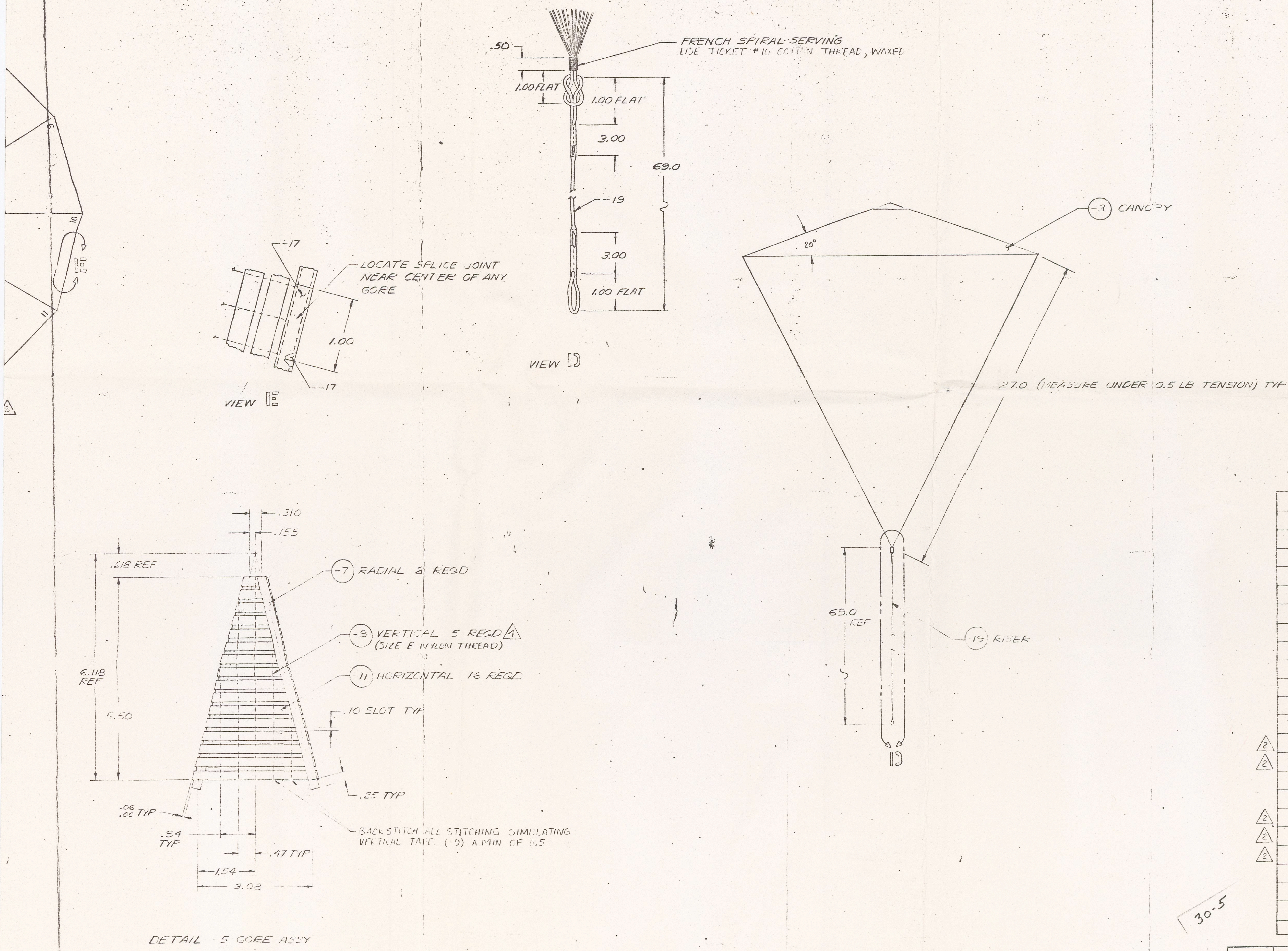
DETAIL -3 SIDE 7C

This envelope contains drawing 86378
Parachute Assembly, 20° Conical Ribbon,
1.0 Ft Do, 24% Porosity

Note: See table V for modifications incorporated into the fabricated parachutes.

NOTES: UNLESS OTHERWISE SPECIFIED

1. STITCHING: SIZE E NYLON THREAD (10 TO 12 STITCHES PER INCH)
2. (2) COLOR NATURAL
3. CUT ENDS OF TAPES ARE TO BE TREATED WITH ANTI-FRAY COATING
4. (4) MEASURE UNDER 0.5 LB TENSION
5. ATTACH IDENTITY TAG TO RISER END. INCLUDE FOLLOWING INFORMATION: PART NAME, PART NO., SERIAL NO., DATE OF MFG AND NAME OF MANUFACTURER. RUBBER STAMP PART NO. AND SERIAL NO. ON GORE 12. (.12 – .25 CHARACTERS)
6. (6) RUBBER STAMP GORE NO'S NEAR LOWER R.H. CORNER (.12 – .25 CHARACTERS)
7. HEAT BASTING WITH HOT NEEDLE IS ACCEPTABLE
8. MASKING TAPE MAY BE USED TO CONTROL HORIZONTAL RIBBON SPACING WHEN STITCHING VERTICALS (TAPE ON ONE SIDE ONLY)
9. MIN. E.D. FOR STITCHING OF WEBBINGS AND TAPES .06



30-5

	-5	-3	-1	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	SPECIFICATION	MATERIAL OR NOTE	ZONE	ITEM NO.
										23
										22
										21
										20
			AR			THREAD SIZE "FF"	V-T-295 TYPE I CLASS I	NYLON O.D. OR SAGE GREEN SHADE OPTIONAL		19
	AR	AR	AR			THREAD SIZE "E"	V-T-295 TYPE I CLASS I	NYLON O.D. OR SAGE GREEN SHADE OPTIONAL		18
			AR			THREAD TICKET #10	V-T-276 TYPE III B	COTTON THREAD		17
										16
										15
										14
										13
										12
										11
(2)			1		-19	RISER 770 LG	MIL-C-7515 TYPE XIV	NYLON CORD	4	10
(2)		1			-17	POCKET BAND .25 X 38.5	MIL-T-5608 TYPE I, CL A	NYLON TAPE	11	9
			6		-15	VENT LINE SIZE "FF" X 2.5	V-T-295 TYPE I CLASS I	NYLON THREAD	11	8
			6		-13	SUSPENSION LINE SIZE "FF" X 61.0	V-T-295 TYPE I CLASS I	NYLON THREAD	11	7
(2)	16				-11	HORIZONTAL .25 X NOTED	MIL-T-5608 TYPE I, CL A	NYLON TAPE	7	6
(2)	5				-9	VERTICAL, THREAD SIZE E X NOTED	V-T-[illegible] TYPE I, CL I	NYLON [illegible] OR SAGE GREEN	7	5
(2)	2				-7	RADIAL .25 X 6.00	MIL-T-5608 TYPE I, CL A	NYLON TAPE	7	4
		12			-5	GORE ASSY				3
			1		-3	CANOPY ASSY			4	2
										1

REQD PER ASSY

PARTS LIST

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
ANGULAR TOLERANCE
LINEAR — HUNDREDTHS ± .030
THOUSANDTHS ± .010

ON SHEET METAL PARTS: ALL BEND RELIEF & INSIDE CORNER RADII .16. OUTSIDE CORNERS .22 RADIUS OPTIONAL. THESE ARE MINIMUM ROUTER REQUIREMENTS.

√ INDICATES SURFACE ROUGHNESS PER USAS B46.1

FABRICATE PER SPEC

CONTRACT NO.

		DATE
DRAFTSMAN	L. Parson	2/6/74
DESIGN APPROVAL	[illegible]	[illegible]
STRESS	[illegible]	2/6/74
CHECK	[illegible]	[illegible]
PROJECT OFFICE	[illegible]	[illegible]
CUSTOMER APPROVAL		

TITLE
PARACHUTE ASSY - 20° CONICAL RIBBON 1.0 FT D_o λ_G = 24% ($\frac{1}{8}$ SCALE OF 8.0 FT D_o PARACHUTE)

SIZE	CODE IDENT NO.	NO.
J	77646	86378

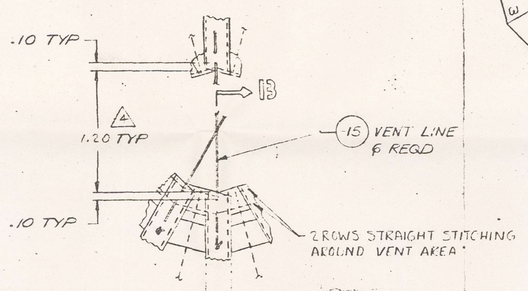
SCALE NONE WT SHEET 1 OF 1

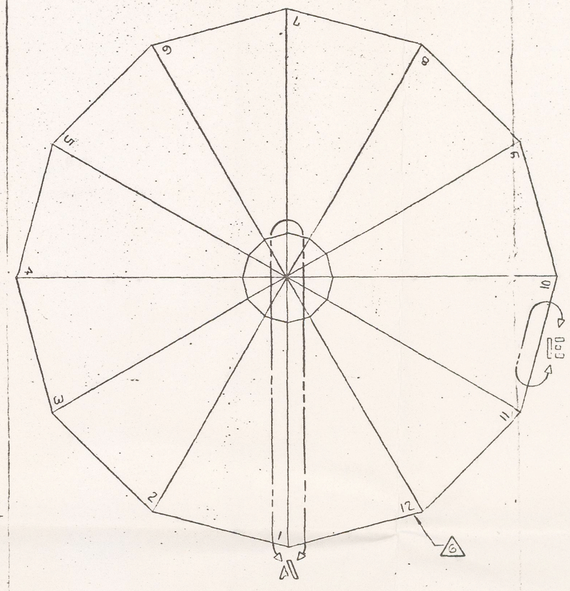
FORM 30-433 REV. 9-68

FRAME 1 OF 2

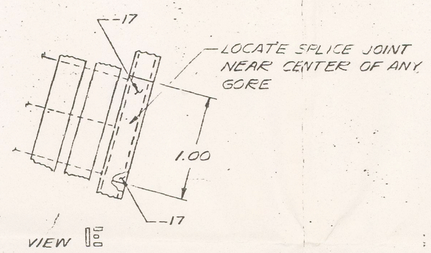
NOTES: UNLESS OTHERWISE SPECIFIED

1. STITCHING: SIZE E NYLON THREAD (10 TO 12 STITCHES PER INCH)
2. COLOR NATURAL
3. CUT ENDS OF TAPES ARE TO BE TREATED WITH ANTI-FRAY COATING
4. MEASURE UNDER 0.5 LB TENSION

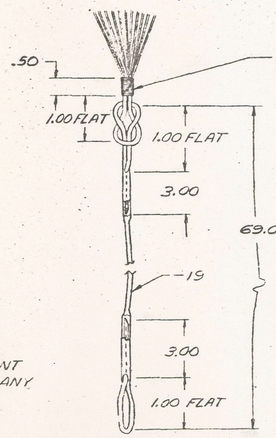




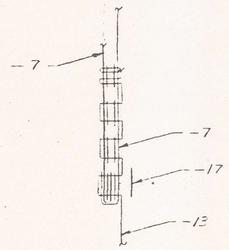
DETAIL -3 CANOPY ASSY



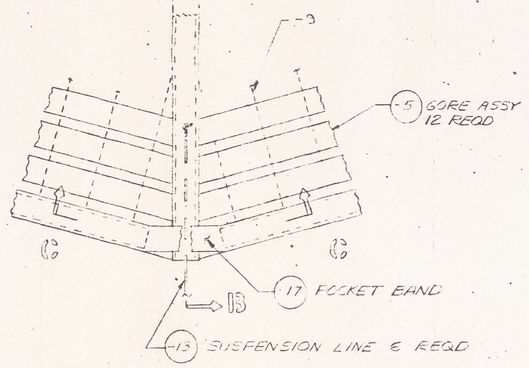
VIEW



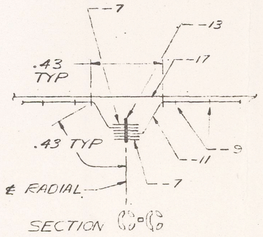
VIEW



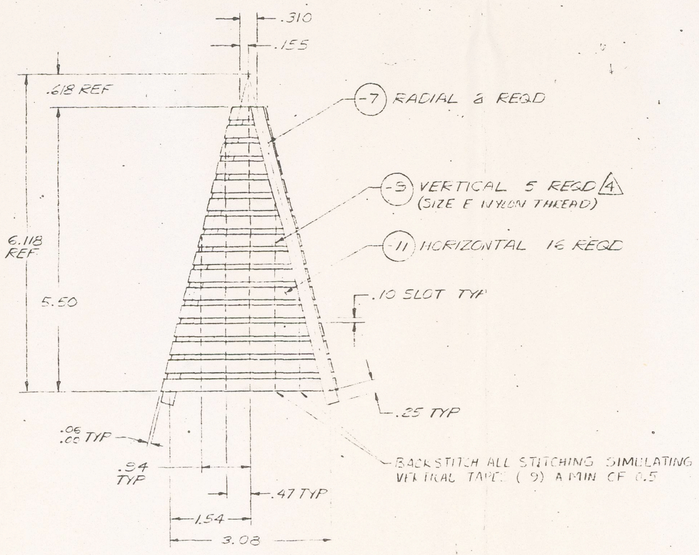
SECTION



VIEW



SECTION



DETAIL -5 GORE ASSY

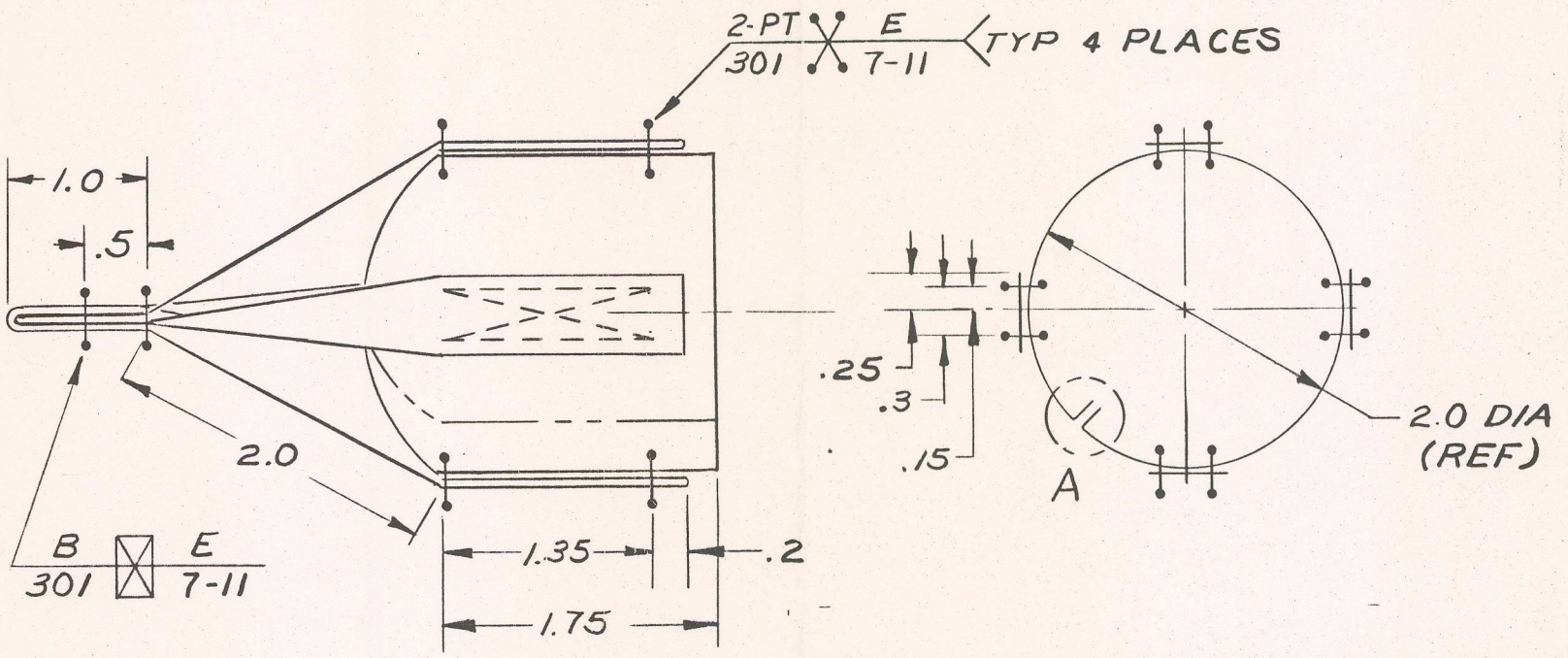
FRAME 2 OF 2

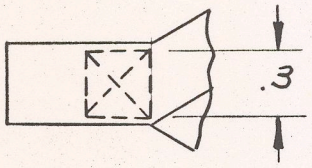
30-5

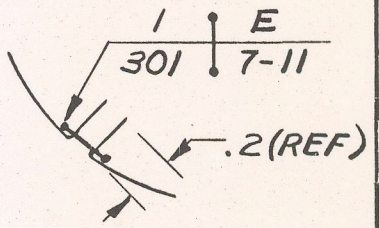
86398

This envelope contains drawing 74QS892

Deployment Bag, Pilot





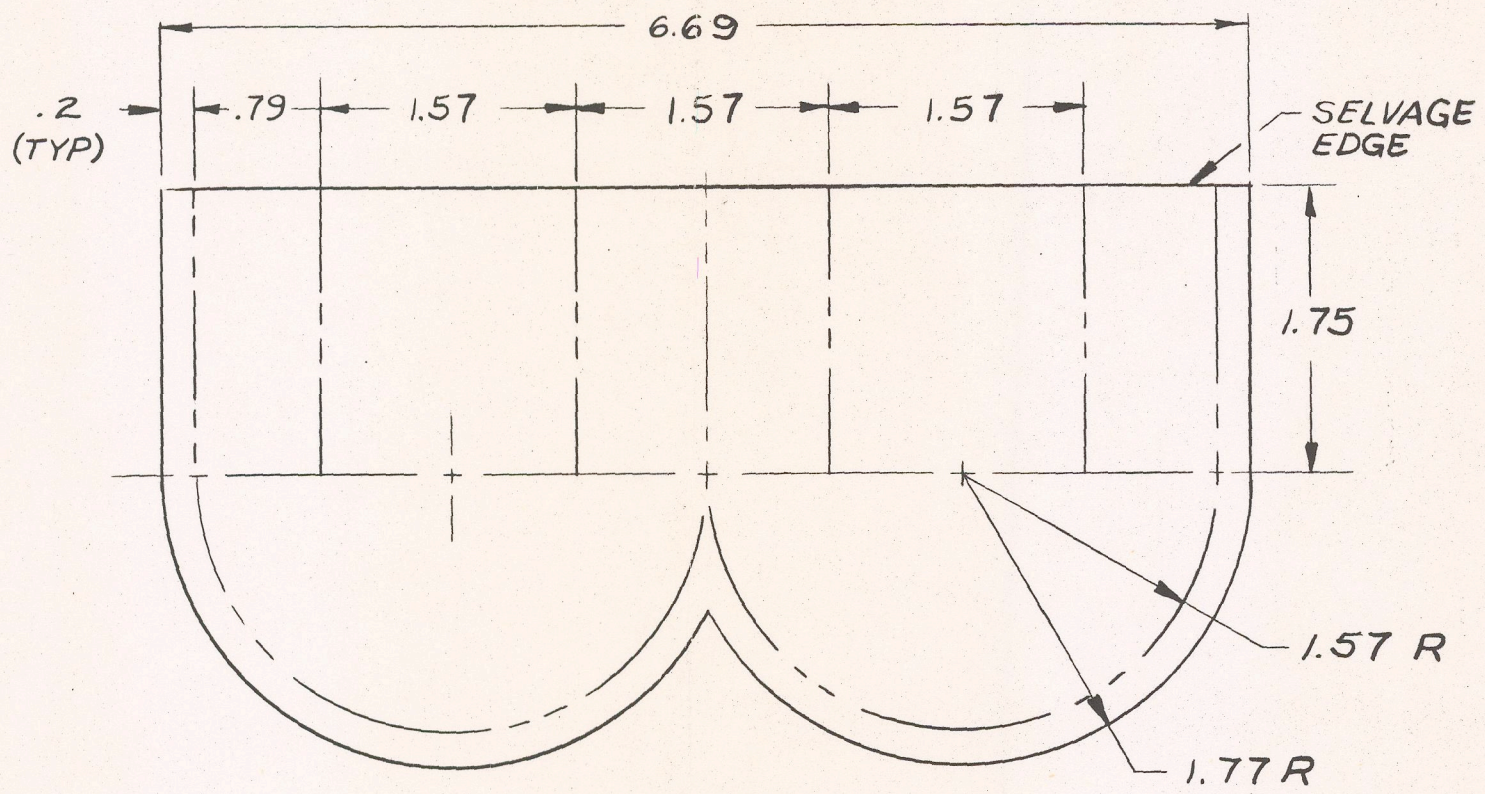


VIEW A

QTY RQD	CODE IDENT	NOMENCLATURE	MATERIAL
AR		THREAD	V-T-295 TYPE I CLASS I
2	-3	TAPE	MIL-T-5038 TYPE III 1/2"
1	-1	PATTERN	MIL-C-10296 CLASS I
X	-101	DEPLOYMENT BAG, PILOT	

SIZE	CODE IDENT NO.	DRAWING NO.
	25500	74QS892

SCALE NONE | DRAWN HENKE 6/18/74 | SHEET 1 OF 2



-1 PATTERN

Summary

Under Contract NAS8-30848, Goodyear Aerospace Corporation provided to George C Marshall Space Flight Center the following.

a. Three 12.5% scale drogue parachute models as described in NASA supplied drawing 86375 which has a porosity of 16% and three 12.5% scale drogue parachute models as described in NASA supplied drawing 86376 which has a porosity of 24%.

   Deployment bags were furnished for each of the six drogue parachute models in accordance with NASA supplied drawing 86377.

b. Two 12.5% scale pilot parachute models as outlined in the NASA supplied drawing 86378. Deployment bags were furnished for each of the two pilot parachute models in accordance with GAC drawing 74QS892.

c. This final report.

In supplying the above hardware, GAC also.

a. Reviewed each of the drawings. Recommendations were made and incorporated into the fabrication of the parachutes and deployment bags.

b. Fabricated tooling aids for the 86375-1, 86376-1, and the 86378-1 parachutes to insure accurate placement of the horizontal ribbons and radial tapes during fabrication of the gores.

c. Obtained dimensional measurements and overall porosity measurements on each of the parachutes fabricated to insure a data base for interpretation of the wind tunnel test data.

2. Drawing Review

The drogue parachute models, pilot parachute models and their deployment bags were fabricated according to the following drawing.

drogue parachute model	Dwg. No. 86375 and Dwg. No. 86376
deployment bag	Dwg. No. 86377
pilot parachute	Dwg. No. 86378

A copy of each is contained in Appendix A.

In addition, GAC fabricated two pilot deployment bags according to GAC drawing 74QS892. A copy of this drawing is also contained in Appendix A.

Each of the drawings were reviewed for consistency of design in-light of their intended use with the result that the changes listed in Tables I through V, were recommended and incorporated into the design of the parachute.

The major difference between the original drawing and that recommended by GAC was the number of horizontal ribbons in each parachute to maintain the desired geometric porosity.

Examination of the MIL-T-5608 Class A, Type I, 1/4 inch wide material received for use as horizontal ribbons in the parachute showed that the material was generally less than the nominal 0.25 inches width as defined in the specification. Ten rolls of the 41 received were measured using a 1/100 inch scale steel rule under 2X magnification. The average width of the ten rolls was 0.234 inches. The specification defines the width tolerance as $\pm$ 0.0156 inches. For the low tolerance the allowable width is 0.2344 inches.